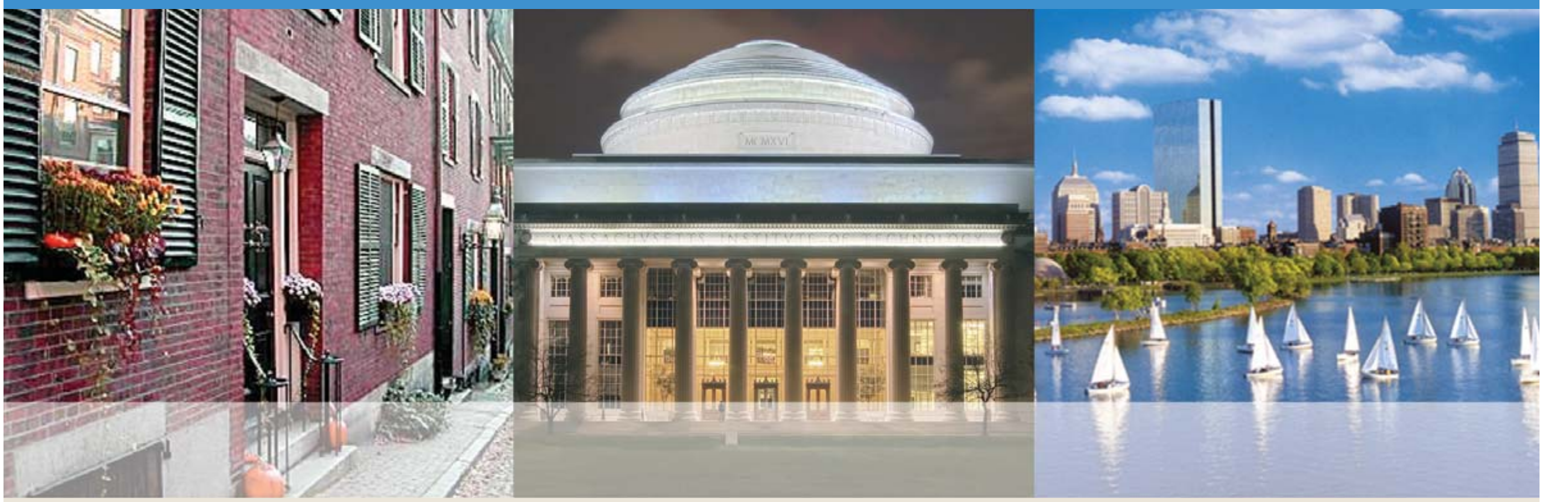
LINC 2013 Conference



Proceedings

Realizing the Dream:

Education Becoming Available to All. Will the World Take Advantage?

The Sixth Conference of MIT's Learning International Networks Consortium

June 16th – 19th, 2013

MIT, Cambridge, Massachusetts, USA

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Foreword

From June 16 to June 19, 2013, the Sixth Conference of MIT's Learning International Networks Consortium (LINC) convened on the MIT campus. Nearly 300 dedicated educators from 49 countries gathered to discuss technology-enabled education, centered around the theme: "Realizing the Dream: Education Becoming Available to All. Will the World Take Advantage?"

In his opening remarks, conference host Professor Richard Larson gratefully acknowledged the support of Platinum Sponsor Universiti Teknologi Malaysia (UTM), MIT's Office of Digital Learning (ODL), Fujitsu, The Babar Ali Foundation, and Glenn Strehle. Attendees were welcomed by MIT's Chancellor Eric Grimson who set the tone for the conference by stating: "Education at all levels, but especially higher education, is in the midst of a tsunami, a tsunami of change fueled by many things – fueled by internet technologies, fueled by computer technologies, but also fueled by people."

The conference featured 20 distinguished plenary speakers discussing this transformative tidal wave in digital education. Topics included Massive Online Open Courses (MOOCs), Open Educational Resources (OER), the future of Virtual Universities, and blended learning through the use of videos such as those produced by MIT's BLOSSOMS Initiative. Speakers also explored assessment tools and technologies, the role of public policy, and the impact e-learning will have on K-12 as well as higher education. Personal accounts from three students who shared their perspectives on technology-enabled learning at MIT provided an ideal closing to the plenary sessions.

The 10 parallel sessions highlighted 67 presentations selected from approximately 100 submitted papers. Presenters traveled from all over the globe to participate in the parallel sessions. India, Ivory Coast, Pakistan, Russia, Thailand, Turkey and Colombia are a modest sampling of the countries that were represented. As diverse as they were dynamic, paper themes addressed issues such as impediments to internet connectivity around the world, the critical role of the teacher in successful technology-enabled education, and the creative use of social media, among many other topics.

Unique features of LINC 2013 included a Twitter feed during the panel sessions and a daily "Storify", which summarized reflections, photos and tweets throughout the conference. Attendees of the Conference Dinner held on June 17 will also long remember the appearance of a spectacular double rainbow that provided a stunning backdrop to the lively dinner conversation. It is difficult to conceive of a more appropriate visual representation of LINC 2013. A rainbow is a spectrum of colors produced by the dispersion of light; the LINC 2013 Conference was also a spectrum. A spectrum of the visions and hopes about how technology-enabled education can disperse knowledge, and bring us closer to realizing the dream of education becoming available to all.

Annmarie Foley, Editor
The 2013 MIT LINC Conference Proceedings
Cambridge, MA, USA
September 2013

A very special thank you to Janice Hall who has created MIT LINC's wonderful web presence not only for the 2013 LINC conference, but for all five previous conferences as well.

In Memoriam

MIT LINC is sad to announce the passing of Professor Babatunde Ipaye on July 3rd in London. Professor Ipaye had attended the 2007 LINC conference in Jordan and also the 2010 conference at MIT. He was planning to attend the 2013 conference before illness intervened. We are pleased to include his accepted paper in these *Proceedings,* but filled with sorrow by the loss of this valued and wise member of the MIT LINC family.

Massachusetts Institute of Technology

L. Rafael Reif, *President*

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June 16, 2013

Dear Participant of MIT LINC 2013:

On behalf of the MIT Learning International Networks Consortium (MIT LINC), I am pleased to welcome you to this sixth international meeting on "Realizing the Dream: Education Becoming Available to All. Will the World Take Advantage?" We are thrilled to hold this conference on our campus and to extend our hospitality to professionals from over forty countries.

You bring extraordinary expertise to this conference, and we are eager to learn from your experiences, plans, and strategies. Your involvement with the ever-expanding dimensions of technology-enabled learning is invaluable and will help shape important research and outreach policies.

We are indebted to the many MIT volunteers and to the universities, companies, and foundations that have made this conference possible. In true MIT spirit, the bar is set high, and we are grateful that your professional, academic, and entrepreneurial exchanges at the conference will move LINC forward as a growing and sustainable organization.

Sincerely,

Rafael Reif

L. Rafael Reif

LRR/rcl

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MIT cesf

LINC 2013 Conference

June 1, 2013

Dear LINC Participant:

Welcome to MIT LINC 2013, our sixth international LINC conference! Whether you have traveled from Brazil, Thailand, Pakistan, the U.K., Mexico, Kenya, India, Malaysia, or one of many other locations, we very much value your presence at LINC 2013. You, the participants of LINC 2013, represent over 40 countries, presenting 80 papers, together with 19 plenary speakers.

LINC, ***Learning International Networks Consortium***, is an MIT-based all-volunteer effort started eleven years ago. By attending LINC, you have joined our LINC family, representing concerned professionals from many countries – each wanting to leverage technology to improve educational opportunities for under-served communities in their respective regions.

The theme of LINC 2013 is ***"Realizing the Dream: Education Becoming Available to All. Will the World Take Advantage?"*** Worldwide, education is experiencing a virtual tsunami of change, made possible by the Internet, computers and the willingness of many to post their educational content online for free -- as part of Open Educational Resources (OER). Add to this the new invention of MOOC's, *Massive Open Online Courses*, and the ingredients for transformation are there. All of this and more will be presented, discussed and debated over the next few days.

LINC 2013 would not be possible without the dedicated efforts of our volunteers and the financial support of our sponsors, most notably Universiti Teknologi Malaysia (UTM) with its generous $50,000 platinum sponsorship. We also thank MIT's internal $50,000 sponsor, the Office of Digital Learning (ODL), home of MITx, OpenCourseWare, the Office of Educational Innovation and Technology (OEIT), and other technology-enabled educational initiatives. Also at MIT, we especially thank the efforts of the Engineering Systems Division (ESD).

Please let us know how we can serve you better in your time here. Feel free to stop any one of the LINC volunteers to inquire about any issue or to make suggestions. And we will be soliciting your formal feedback in a short online evaluation questionnaire. We hope you choose to complete it after your stay with us. **Again, welcome to LINC 2013!**

Sincerely yours,

Richard C. Larson

Richard C. Larson
Professor, Founder and Director of LINC, MIT

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Thank You to our LINC Volunteers

The 2013 MIT LINC Conference would not have been possible without the countless hours devoted to the conference by our volunteers, members of our LINC 2013 Planning Committee. These wonderful professionals, whose names appear below, were remarkable in their energy and commitment to the success of MIT LINC 2013. Some of them have been with us for many years, volunteering time and time again, and others are new to LINC. We thank each and every one of them for their tireless service.

Professor Richard C. Larson
Mitsui Professor of Engineering Systems
Director, Center for Engineering Systems Fundamentals
Founder and Director, Learning International Networks Consortium

2013 MIT LINC Conference Planning Committee

Elizabeth Murray, Chair -- LINC 2013 Conference Planning Committee
Assistant Director, MIT LINC
Project Manager, MIT BLOSSOMS

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Esha Sahai
Masters Student, Systems Design and Management
MIT Engineering Systems Division

Carol Sardo
Longtime LINC Volunteer

Janet Wasserstein
Senior Associate Director
MIT Office of Foundation Relations

Conference Framing

Richard Larson
Director of MIT LINC

Good morning everyone. It's so nice to see you. Probably could say good morning in about 25 different languages. Let's try it. Good morning in you language. Good morning. Fantastic. Fantastic. My name is Dick Larson. And off-and-on over the next 2 and 1/2 days, I'll be playing your host. And everyone finds that very funny, that I'm going to be your host. And so let's get started. We have an action-packed agenda, and we have to keep on schedule. So already, I'm 30 seconds behind schedule, so excuse me.

Welcome to LINC 2013. We have represented here, and you should all give yourselves a round of applause, 49 countries. Over 300 participants. We don't know how many were walk-ons today, but at the last count, it's slightly over 300. And others are joining us by the internet, live streaming. Welcome, those of you who are watching us from your computer at home or at work or wherever you are.

The credo of LINC. LINC was born in 2002 by a number of us volunteers at MIT and in other countries. We have partners who are co-inventors of LINC also, and some of them are here today. “With today's computer and telecommunications technologies, every young person could have a quality education, regardless of his or her place of birth or wealth of parents.” That's something we started. That's a phrase has not changed since 2002.

And yet, if you look at the technologies that have changed in the last 11 years, we're getting closer and closer and closer to that possibility, at least on a technological basis. So that's the theme of LINC 2013. And you'll hear about MOOCs this morning – Massive Online Open Courses – which are providing learning opportunities worldwide to hundreds of thousands of students. So what might be the impact of those now and in the future? Innovations in educational technology, like mobile technologies. Impediments to bringing in education. Some of these are political, cultural, economic, training, those kinds of issues. Impact of technology in lowering the cost of education.

So LINC was formed in 2002. In 2003, we had the first LINC conference, thanks to the Lounsbery Foundation in Washington, DC. In February 2003, we had 80 participants. Now, we have over 300 here. We had 15 countries represented then. Today, we have 49. We also had LINC conferences in 2004, 2005, 2007, and 2010. And there is a group of folks who were there with us at LINC 2005. And if you look carefully, I'm not going to give you enough time to do this, you'll see some faces there that are still here today. And none of us have aged at all, guaranteed.

Now, LINC 2007 was kind of special, because it's the one that we did not do here on the MIT campus. And you see Her Majesty Queen Rania sitting there, next to Phil Clay, who served as Chancellor during that period of time. On her right are the Minister of Education and the Minister of Higher Education. I don't know who that guy is on the outside there. So there are some shots. We had some fun, too, outdoors and that sort of thing. And there's one of the shots when we were in Dubai.

Now, at LINC 2010, which was the last LINC that we had, Charles M. Vest – Chuck Vest as we call him, former President of MIT and now President of the National Academy of Engineering – served as our keynote speaker. We had 19 plenary speakers. By the way, all the plenary speakers' speeches are on video and on our LINC website, if you want to see what they said in 2010. And same thing here today, even though we're live streaming this over the internet, we're also recording it. And within a few weeks, maybe even sooner, all the plenary sessions will be up on the LINC 2013 website. Now, I'm not going to show you the names of all the plenary speakers in 2010. But the people I'm about to show you now are here at LINC 2013 and are either plenary speakers or session chairs or presented a contributed paper.

Now, Vijay Kumar – Vijay are you here this early? OK, he's not here this early. He was going to go to a wedding in India this week, but he's decided not to. So he's going to be here instead. But obviously, he's not here this early. All these people, you're going to be hearing from. Cliff, by the way, is the LINC speaker tomorrow. Are you pointing to me? There, how are you doing? Welcome. David Pritchard, he's presenting some papers on his statistical analysis of MOOCs that have been offered by MIT so far.

So let's not forget our focus. Now, when LINC started, we were exclusively tertiary, exclusively college and university. We're engineers. It takes us a while to think about these things. But it's come to our attention that the outputs of high schools are the inputs to colleges and universities. So therefore, it's not appropriate for universities to ignore what's going on at high schools, and maybe even lower grades or primary grades.

So starting, particularly, LINC 2007, we started talking also about high schools, particularly STEM projects, STEM classes: science, technology, engineering, and math. So since LINC 2007, we've been high school science, technology, engineering, and math, as well as universities and colleges. So we think about that. Let's not forget our focus, which are the students, and the students can be pre-university or in the university.

These are some photographs from Ningxia province we took in 2004 in China. Dakar, Senegal. Northern Mexico, in a very poor, rural village. We have interesting stories about Mexico, how 10-year-olds got credentials that usually 29-year-olds had a hard time doing. Here are students just outside of Islamabad in Pakistan taking a written doctoral exam in physics. Professor Pervez Hoodbhoy, who has a degree from MIT and is one of the most famous physicists in Pakistan. Notice how dutifully they're taking their exam, and also notice that the majority of them are females.

Here are high school students taking a math exam just north of Lahore, Pakistan. And why are they sitting on the sidewalk taking the exam? Anyone have any ideas? I know Naveed Malik has an idea, because he was with me when I took the photograph. Hi Naveed. It's because the electricity provided to schools and most other things in Lahore, Pakistan is a square wave, on one hour, off one hour, on one hour, off one hour. And the time of this class would happen to coincide when the electricity was off. The classroom was too dark to read the exam or to write the exam. So they were sitting outside doing it. This is an example of the kind of impediments we face in emerging countries.

We want to thank many, many people and organizations. UTM of Malaysia, University of Technology Malaysia is our platinum sponsor. Thank you, UTM. We could not have done this conference without you. Will the UTM people stand up please? Fantastic partnership. We also want to thank MIT's Office of Digital Learning, which is the MIT sponsor. And I don't think Sanjay is here at the moment. Ah, but Ike can stand. Ike also is with the Office of Digital Learning. Ike, stand up. We'll give a round of applause. We have Fujitsu as a sponsor. Are the Fujitsu people here today? Ah, Kanji, get up. Thank you very much. And the Babar Ali Foundation from Pakistan also provided some travel scholarships for some of our visitors today, our participants from Pakistan. We thank them.

And now, let's not forget MIT. MIT really provided a lot of energy and enthusiasm here and time of the volunteers. So we thank MIT. We thank my home department, which is Engineering Systems Division. Because when we were working on LINC, we weren't doing other things that they might have wanted us to do, so we thank them. We thank MIT OpenCourseWare, which provided a lot of service for us and volunteers. The Office of Educational Innovation and Technology, OEIT, provided lots of us support for us. The MIT Office of Professional Education provided lots of support as well.

And Glenn Strehle, I don't know if Glenn Strehle is here today? He also provided support for this conference. He's now treasurer of the Lounsbery Foundation, and was a very famous treasurer of MIT. Up through the late '90s, he worked with me at the Center for Advanced Educational Services for a while. We co-authored a chapter together. He helped form MIT World. So we thank him as well. And here's the Planning Committee. And these are the people who should get the biggest round of applause, because without their labor and their intensity, it couldn't have happened.

Now, you might ask, what is LINC? Well, LINC is you. And basically, you are leaders in technology-enabled education from around the world, focused on tertiary education, colleges and universities, but also including high school STEM-focused education. Some of you are professors. Some of you are NGOs. Some of you are in government. Some of you are students. All of the above and many more. What happens is we get together and we share best practices, worse practices, what makes things difficult, what makes things easy. And also, we're trying to have enough time for you to circulate Lobby 13 at the hotel, and around lunch, so you get to meet your colleagues from around the world. Remember, whatever country you're from, they're 48 other countries here. In the past, LINC has been quite successful at forming partnerships, like Mexico and China, or Ireland and Saudi Arabia. Things happen. And as a result, other programs start after LINC. So that's basically what LINC is all about. And so we hope you engage in those kinds of activities while you're here and have a very productive and enjoyable time.

Welcoming Remarks

Eric Grimson
Chancellor of MIT

Let me first offer a welcome to everyone on behalf of MIT and its administration. We are delighted that this conference is being held here, and as Dick said, more than 300 people from almost 50 countries. I think this is really fantastic.

If this is your first trip to MIT, welcome, and I very much hope that you get a chance to take a little bit of time during the breaks and explore the campus and get a sense of some of the vibrancy of this institution. It's a little quieter now because many of the students are gone, but you will get a sense of the pulse of the place and the things that make MIT, I think, special. If this is a repeat visit, welcome back. You already know about the vibrancy of the place, and I hope you get to drink from the fire hose yet again.

As Dick said, this is the 11th year of operation of LINC and the sixth conference to be hosted by it. Many parts of MIT, as he noted, do support LINC – OCW, OEIT, ESD, iLabs – but also the senior administration. We very much resonate with the premise of LINC, which Dick highlighted. Namely that with today's computer and telecommunications technologies, every young person can have a quality education regardless of his or her place of birth.

Indeed, as I noticed on LINC's website, it has a wonderful quote, at least in my mind. It says, "Until recently, the assets of a country lay buried underground such as oil, gas, gold, silver, and diamonds. Today, the key assets of a country lie buried between the ears of its citizens. Educating the mind is the key to a better tomorrow for all." It's a wonderful quote, and it's a concept that in many ways, I think, is even more relevant today than it was 10 or 11 years ago, when Dick launched LINC.

As I'm sure you're all aware, education at all levels, but especially higher education, is in the midst of a tsunami, a tsunami of change fueled by many things – fueled by internet, technologies, fueled by computer technologies, but also fueled by people. And we here at MIT have, in many ways, been in the middle of this for years. MOOCs, Massive Open Online Courses, as represented by MITx and edX, which will be featured in this morning's plenary session, certainly represent one way to bring tertiary education to all. And of course, there are others.

I want to just say a few words about why MIT chose to launch MITx, why we partnered with Harvard to launch edX, now joined by more than two dozen other very strong universities and colleges around the world, and why we remain firmly committed to leveraging the tools and the role of online technology in education, whether remote or residential. I think our history of involvement in online tools and educational issues probably goes back a long time. I'm not certain that William Barton Rogers, our founder, did it in 1861, but I'm sure he had the idea. I think perhaps one of the most visible efforts was our launching of OpenCourseWare more than 10 years ago.

Now, Cecilia d'Oliveira is here. She can tell me if I have it right. My recollection when we launched OCW was that the primary motivation was to distribute teaching materials to our colleagues around the world, other educators. But it quickly grew to be something more, and we learned from that. We've had more than 100 million visitors, including several hundred thousand regular visitors each month. They come to view videos, they come to do problem sets, they come to work their way through course materials.

We also learned, I think very importantly, that more than half of those viewers are self learners. They're not college students. They're people of all ages, and that caused us to think here at MIT about other ways in which we could explore this. Over the past 10 years, we have explored a range of experiments in online tools for changing the way we think about teaching, and that culminated in the launch of MITx and then edX.

I want to just give you – because they get lost a little bit in the sense of MOOCs – when MIT launched it, there were three reasons why we really wanted to do this, and we still firmly believe that we can harness, if you like, the energy of the tsunami to accomplish those three goals. The first was to rethink the residential educational experience in a world of online access and online tools. Whether that's using SPOCs – if you haven't heard the term, it's the opposite of a MOOC, a SPOC is a Small Private Online Course – or other methods, how do we think about using those tools to empower and strengthen what happens for our students here on campus?

The second reason was we wanted to provide an MIT quality educational experience, and I should say, an MIT heart educational experience, to anyone around the world with the desire to do so and with access to the internet, again, using MOOCs. Thirdly, and equally importantly, we wanted to conduct research on learning. We wanted to mine the incredible data that is available to us as we think about what happens in those online courses in order to better understand how students learn, how we can tailor our delivery to lead toward the ultimate goal of a more personalized educational experience that matches the capabilities of that student with the technologies that we can provide.

I think this latter point really very naturally fits with MIT's core values. We are fundamentally a research institution that cares, at the same time, deeply about education. Hence, we are very eager to engage in some very deep and extended research on that topic in order to better understand how to link learners with teachers, with pedagogy, and with the technology. So for example, we've already begun to explore, together with our partners that edX, how to create automated tools for assessment of a wide range of areas, whether that's questions on electronics, on physics, on chemistry, on abstract mathematics, or even tools to grade short 250-word essays automatically, to provide immediate feedback to students, which we think is one of the great things that will strengthen what we can do in this domain.

We've also begun to explore ways to collaborate with other institutions, such as teaching classes in a blended fashion with community colleges here in the United States and starting, I think in a few days, we're going to be teaching an introductory class on programming to high school students in Chicago. And we're going to continue to experiment with how to use these tools to create better experiences for our own students.

So in many ways, as Dick put up when he put up his slide, the focus of this year's conference, I think, is very proper to MIT's role and why we're excited to have them here. Realizing the dream, education becoming available to all. Will the world take advantage? As Dick already highlighted, many of us are very interested in the technology. I certainly am. I'm delighted to see what we can do with it. But the technology alone will only be part of the answer. It will also be the opportunity, the access, and frankly, the local support – whether it's from local governments or simply local individuals – to provide the opportunities to really change the way education is delivered around the world.

So hopefully over the next three days here at LINC, you're going to learn about the kinds of complexities being addressed by all of you, learn some best practices, and help articulate some of the places where we still have work to do. And I hope you especially get a sense of the rapid change that is happening as these online tools come along and how they can fit into the mission of LINC to really take the next step in providing quality education around the world to anybody with the desire and the capability to access it. I hate to put you on the spot, Dick, but since you put me on the spot, I do trust that you'll give me a good sense at the end of this of lessons learned that MIT could use as we think about how we change the way we teach as well.

With that, I hope you get a chance to enjoy Boston. I especially hope you get a chance to enjoy MIT. And I trust you will have a very productive and fascinating conference over the next three days. Welcome.

The MIT LINC 2013 Conference

Plenary Speakers

MIT's Building 10 - the Maclaurin Building
Venue for the 2013 LINC Conference

The Developing World of MOOCs

Anant Agarwal
President of edX

OK, good morning. It's actually really fun to listen to two of the presentations before. And as an academic, it's a real challenge not to start the discussion right now.

We all are really big fans of the open education resource movement pioneered by OpenCourseWare. And I was actually at the UNESCO meeting along with Steve Carson from OCW. This was on June 22 of last year in UNESCO.

And it's amazing, the number of countries and world leaders that are involved in something that started out pretty small but really became a worldwide movement. Let me echo John's comment that it is actually tragic that MOOCs are supposed to be open, and it's about open access. They have not moved to open content, and I for one, really exhort all our universities to move to open content.

I do want to give a big pat on the back to Delft University. EdX has 27 international partners having courses on edX, and Delft is the one partner that has come on board onto the platform, putting all its courseware as a MOOC under a Creative Commons license. So they're the first ones to do that, and I'm hoping that others will follow, including some of the leaders of the OER movement.

So today, let me talk about MOOCs and where things are going and so on, and I'll start with the developing world. So this is a classroom, believe it or not, in India. So this is under a bypass highway. It's interesting to see that there are multiple classes going on. And this is a classroom at this little institution, a private institution in the northeast of the US with three letters in its name. The first one begins with an M.

And you look at what's different from the previous classroom and this one. I think this has sliding blackboards, which is pretty nice. The other classroom did not have sliding blackboards. But I think this points to a fundamental issue in our education systems – that really not much has changed in hundreds of years. John showed a set of pictures from tablets and so on with a sage at the stage lecturing and learners learning. Now there have been many ideas that have popped up, various forms of the flipped classroom model that's happened. But if you look at the predominant majority of what's going on, not a whole lot has changed.

We also have a real issue with access to education. So believe it or not, this is not a rock concert, and that's not Madonna. This is a classroom at the Obafemi Awolowo University in Nigeria. And we've all heard of distance education, but those students sitting in the back 200 feet away from the professor, that is long-distance education.

So there is a real challenge with access to education as well. So edX was formed as a nonprofit venture founded by Harvard and MIT with several goals in mind. One goal was to increase access to education. The missions of our universities are to increase access and make education and knowledge available to everybody, so access is a big part of what we do. An equally important part is to improve education period – improve on-campus education, improve online education, simply improve education. That was a really important part of our mission as well.

A third big part was open source platform. Why is open source platform important? As both our previous speakers pointed out, even with MOOCs, a precious few universities have gotten into it, have had the opportunity of jumping into it. EdX has 27 international partners. If you look at Udacity, they have a few. Coursera has 80 or 90 or thereabouts. So not a whole lot of people have had access to this kind of new technology that's coming out.

So what edX did was, we felt that there was really no way, given the closeness with which we wanted to work with our partners, no way that we could create a peer community that was really large. So we said, by open sourcing our platform, we add a second O in the picture. Open access. We're looking to get open content over time, and Delft has started that movement. We're also looking to get an open source platform on edX.

So two weeks ago, edX, true to its word, made its platform available as open source to the world. This means that the software that we are developing is free. Anybody can pick it up and do what they want with it. Our hope is that they will all add to the platform and contribute to it, and it's been really heartening to see.

For example, Stanford came on board the open source platform effort as a collaborator. And in a matter of six weeks, they were able to take edX as open source software. If you go to class.stanford.edu, they launched their MOOC courses on June 11, a week ago, and you will see several courses on there. And they were able to do this and launch their courses, put the content, use the edX authoring platforms in the space of six weeks. And again, Stanford is not any university anywhere in the world, although some on the East Coast may think so. But our hope is that a number of universities can pick up – a lot of universities are picking up the platform and doing it.

There's also a lot of pressure on edX to take one additional step. Folks are saying, hey, edX, why don't you also provide a hosting service? It's this camel-in-the-tent story where the camel keeps coming into the tent more and more. And so it's one of those things where people are looking for a little more from edX, where they're saying, why don't you create a hosted site as well, where it becomes really easy for any university to put up courses? And that is something that we're actively thinking about, so openness is a big deal for us.

Research and learning is another really important part. We view the edX platform as – I like to call it – the particle accelerator for learning. We're gathering a huge amount of data, and we're open about it. We look at mouse clicks. We look at what answers students are giving. And a lot of researchers are analyzing it, and I'll show you some early results from folks such as Lori.

Lori Breslow at MIT, Dave Pritchard at MIT, and Andrew Ho from Harvard are researchers that are using the data and doing research into how students learn, so I'll show you some of the early results that are coming out.

So edX is a nonprofit venture, and our view is that – I think Sanjay put it really well – it's stakeholders versus shareholders. I have my own little play on words there. It's about principle, not profit.

So as we created edX and began this technology, there's been a lot of hype. So my hope here is to go to the next step and see what's happening next. So I think a lot of hype has been caused by two things. One is the caliber of institutions that have put up courses, and second is the numbers. The numbers have been absolutely staggering and befuddling, to say the least.

When edX put its first course online, it was an MITx course on circuits and electronics, a hard course with differential equations as a prerequisite. And we were not shy about advertising hard prerequisites. We were not looking for big numbers. Heck, we were looking for about 2,000 was our sweet spot.

And 155,000 students from 162 countries enrolled in the course. And that caused a lot of anxious moments within edX, because the platform had not been tested beyond on about 20 or 30 people hammering away on it. So of those 155,000 students, 26,000 tried the first problem set "Active Learners." So there's a lot of discussion about attrition in MOOCs and are people all able to complete and so on. And I'd like to pick up on a discussion that John, our previous speaker, began, and I even have a term for it.

If you look at traditional universities, if you look at MIT – I've been part of the admissions process at MIT for many years, at undergraduate and graduate levels. At the undergraduate level, last year we had about 18,000-19,000 students apply. And the number of students that came to campus, we admitted about less than 10%. So about 1,500 came to campus. So less than 10% we admitted.

So we have this funnel. The funnel goes like this: we had a lot of applicants, and then we let people into MIT or into any university through an admissions process and we let this smaller number through the bottom end of the funnel. But the people that could even start are a small number, and so we lose a lot of people in the admissions process. I like to think of MOOCs as flipping the funnel.

What does flipping the funnel mean? It means that anybody can come in, OK? Geography doesn't matter. Your income level doesn't matter. Who you parents were doesn't matter. Whether you were an alumni or not doesn't matter. It doesn't matter how much you've contributed to big new buildings and new campuses or something. Just nothing matters, OK?

All you have to have is the will to learn and an internet connection. Now it's a small matter of a little device. So anybody can come in and take these courses, and the beauty of this is that this completely democratizes education. It becomes a complete meritocracy. Everybody has an equal chance. And if you can cut it, if you can past the muster, you will get a certificate at the end. If you can work hard and if you can do it, you will pass. It doesn't matter what your parents were. It doesn't matter how much money you have.

It doesn't even matter if you don't have the background, because you can go and get the information. We put links to OpenCourseWare, to Khan Academy, so people can go and get the resources as they need, as they're learning. And so this really democratizes education, and people can come in and learn.

We had 155,000 students start the course and 26,000 students tried the first problem set. Many students were just what I call the online equivalent of rubberneckers, online rubberneckers – just were curious. And so 26,000 students were serious. Of those, 7,200 students passed a really hard course and got a certificate.

Now 7,200 is a big number. First of all, it's about 5% of 155,000. That's not very different from the admissions rate of many of the top universities. In fact, it's a much higher admissions rate than the IITs. The admissions rate at the IITs in India is 1%. 1 in 100 students get in.

So 5% of the students did a really hard course, and they got a certificate. I would have to teach at MIT for 40 years twice a year, two semesters, to teach this many students. So don't let the attrition rate of MOOCs fool you.

Just remember the buzzword. I mean, buzzwords are nice. They help you remember things. Think of MOOCs as flipping the funnel. So instead of the funnel being this way, we flip it. Anybody can come in.

Next, let me talk about how MOOCs are impacting campus education. And so here in this country far, far away, two high school teachers. This is in the Sant High School. They blended the classroom. They used the edX course material, and they had students do videos in their own rooms and homes and came to class, and they had to solve problems together, discussions and a lab.

And so this was in a high school, and this was in Mongolia, completely unbeknownst to us at edX. We found a blog, and that's how we discovered them. In fact, this very class in Mongolia produced a prodigy, Battushig. So Battushig was a 15-year-old. This character – and I took this as a personal affront – in the edX circuits course from MITx, this 15-year-old kid scores 100 in the whole course.

Now that was a personal affront to me and Jerry Sussman and my colleagues who put the courses together. Heck, I would not get 100 if I took the exam myself. So this 15-year-old, he's a prodigy. And guess what? He's been admitted to MIT. He's going to MIT this fall.

And then he used the material he developed from this course, and he built a little invention. So he put a little device in the garage of his building where he could provide an early warning system for pedestrians who were leaving the building going up and warn them of cars going across. So this guy was really amazing.

EdX is also doing blended learning pilots in a number of places. Here's an example of an experimental pilot that we did along with San Jose State University. And the early results are very promising, and I'll talk about why we think quality will improve as well. There, semester upon semester in the same circuits course, they had a 40% retake grade. With the blended class, it fell to 9%.

So in future semesters, we're trying to understand what where the sources of the improvement in the outcomes. We have a number of blended pilots happening throughout the world, from Tsinghua in China to Mongolia to Turkey, all the way to the East Coast, Berkeley, and even at the Hawaii Pacific University. The Berkeley course has been used in a dozen places, so a number of these blended pilots are happening in a number of places around the world.

Next let me talk a little bit about why is it that online learning can improve education, whether it's on campus or education anywhere else. What are some of the key aspects, and what is some of the research behind it?

The first idea is called active learning. With active learning, the basic idea is to engage the student while you teach. So what we do at edX is that we have innovated in the UI – User Interface – as well to promote this kind of pedagogy. We show learners 5, 10 brief videos with exercises interweaved.

Now again, this is not a new idea. Eric Grimson and Tomas Lozano-Perez did that here at MIT in a early programming language course in the late '90s. So what edX has done is picked up that idea, innovated a little bit in user interfaces and so on, and made it available on a large scale. And so this interactive form of learning has been known to improve outcomes. This is a landmark paper – if you haven't read it, I strongly urge you to read it – by Craik and Lockhart in '72 that said learning and retention is related to how deeply learners process information as they go along.

A second key idea is self-paced learning. Now in normal lectures, you go to a class and there's a professor who – to use Sanjay's terminology – the professor raves or rants or whatever, and students are listening. If it was me, and the students around me were much brighter in my IIT class and they would be following, I would stop following the lecture around the fifth-minute mark and then scramble to take notes.

Now with online learning, I can watch these videos online. I can pause the videos. I can rewind the videos. And guess what? I can even mute the professor. In fact, in a blended class we taught at MIT, a majority of the students watched exactly like that. They were actually fast forwarding at 1.5x speed and reading the transcript and muting the professor. So this gives you self-paced learning.

There again, there's not a whole lot that's new in MOOCs, folks. Really, there's just really not a whole lot that's new. A paper by Mayer in 2003 showed that students who were able to simply hit the pause button did better than those who were not able to do so. Self-paced learning.

A third idea is instant feedback. So we have a number of technologies – at edX and other MOOCs and in a lot of the tutorials being developed online in a number of places – where we can provide instant feedback to students by using computation to grade the exercises. So here's an example of a learner working with chemical equations. Now we can do a number of these things, and thanks in part to people like Ike Chuang, who single-handedly must have contributed more to the grading technologies at edX than anybody I know.

Can you believe we can now do matrix equations in edX? To my knowledge, no other MOOC can, to my knowledge. I think I complained to Ike, “Ah, we don't have matrices,” and the next morning he comes and tells me, “Hey, Anant, go check it out.” So it's pretty amazing with the contributions we've been getting from everybody.

So here's a quick little demo of students doing chemical equations. And you can enter – you get it wrong, hey, you can learn as you go along. My colleague here, Ed Bertschinger in physics, he made this comment about instant feedback the other day. He was doing the physics course by Walter Lewin on edX, and he had this epiphany, and he sent out this email. In that email, he made this statement, and I think this statement will appear 10 or 20 years from now. It'll really be memorialized. It's just incredible. The statement goes like this. He said, "Instant feedback turns teaching moments into learning outcomes." Just remember that. That is huge.

And this is not going unnoticed by our students. Students are telling us that they go to bed at night dreaming of the green check mark. This has become somewhat of a cult symbol at edX. In fact, there was a student who took the circuits course that my colleagues and I taught the beginning of last year, and then he took a Berkeley software course in the fall. This is what he had to say on the discussion forum when he just joined the course of the green check mark. "Oh god, have I missed you." OK? I mean, can you believe students dreaming of homework? I mean, this has not happened before.

And there again, there's nothing new here, folks. Chen, Whittinghill, and Kadlowec demonstrated that rapid feedback has a significant and positive effect on student performance. There's been research. So there are papers showing all of the stuff we're doing.

Another thing we do is we use simulation technology and virtual gamification technology to create online labs and really engage the students. So here's a circuits laboratory. The challenge with MOOCs is, how do you teach design? OK, we all know analysis. We give you a problem, you go solve it. The real challenge is, how do you teach design? How do you teach creativity? And creativity and design is about building something when nothing existed. Give someone a blank sheet of paper, and how do you build from it? So we do this.

So we have an online lab for the circuits part built by Chris Terman and Jacob White where we use online simulation technology to give students a lab-like experience. So learners can build circuits much like you build an online LEGO system, and they can analyze it, and it can also be graded. So this kind of engagement is also very helpful.

I'm actually not sure who said this but, generally, if you're not sure who said something, it is safe to attribute it to Ben Franklin. So he said, "Tell me and I forget. Teach me and I remember. But engage me and I learn." It's been attributed to many people.

Another key aspect is peer learning, where students are learning from each other. So let me tell you a story here. When we did the first course on edX over a year ago, and we had a lot of students on the platform, I didn't sleep for three nights. We said on the discussion forum, how do we answer questions from this many students? So we had about as many instructors and TAs as we have in a 100-person class on campus. So I said, folks, 7 by 24. We're going to be up all day, all night, answering questions.

So promptly at 2:00 AM at night, I was sitting there, and a question pops in from a learner, I think from Pakistan. And I'm trying to type the answer. I'm not a great typist and as I type, before I can finish, in pops an answer from, I think, someone from Egypt. Ah, not quite the right answer, so I've got to correct the answer.

Before I know it, another answer is put in by someone from the US. I sit back fascinated, and boom, boom, boom, boom. By 4:00 AM in the morning, they've been discussing it, and they get the right answer at the end. And all I had to do was go in and say, good answer. That was an epiphany for me.

Now when I mention this anecdote to my learning colleagues who've been doing research in learning for decades before I got into education, they said, “Oh, yeah. I've known this all along.” So people have know this apparently, but it was an epiphany for me that students are teaching each other. By using technology, we're able to now scale to large numbers where they answer each other's questions. So in a blended class on campus, we also got the feedback from our learners that the ability to pace themselves, the immediate feedback, and the quick responses from the discussion forum were things that they liked a lot.

Finally, in the last couple of minutes I want to talk about the research that we're doing at edX and MIT and Harvard and a number of other universities. So here's some interesting data. Now we all wondered, if students were given the chance, would they watch a video first, or would they do homework? OK, the campus equivalent would be, would they go to lecture first, or would they start a homework first?

So we've got a bunch of data, and what is interesting here is you see the result. So this is for the circuits course. You notice that in the first week, 70% of the learners start by watching the video first, but about 25% start by doing the homework. But as the course wears on, by the time the course is done, it completely flips and 60% of students start with homework, and then they go and get the resources that they need to solve the homework. So this really questions some of the biases we've had all along in terms of what may be the right way to teach.

Another example is from research that Lori Breslow and her team here at MIT and Harvard have done. A simple example. Students say, well, what's the point of homework? Well, here's some data that shows a very strong correlation in your performance in the course in terms of overall grade in the course to the amount of time you spent on the homework. There's a straight correlation between the amount of time you spent on homework to your overall grade in the course.

So we have a lot of data of the sort. Here's some data from Dave Pritchard's research. He looked at what kind of resources the students are looking at. The area of a circle is the amount of time spent on it. So when students are doing homework, you notice that they access lecture videos a lot. But when they begin doing an exam or a midterm exam or a final exam, that flips around, and they begin to access the textbook a lot.

Now my next question to Dave was, “OK, why is that?” “Well,” he said, “that's future work.” So I think we're getting a lot of data in terms of how students are learning, and I think we're now beginning to question, and in turn understand why, this is so. Can we use that knowledge to improve education on our campuses? So with that, let me stop and take some questions. Thank you.

Making Sense of MOOCs:
Musings in a Maze of Myth, Paradox & Possibility

Sir John Daniel
Former President of The Open University (UK),
and of the Commonwealth of Learning

Well, good morning. Sorry for the delay. But at MIT, you've got to get your technology sorted before you start. Thank you, very much, for inviting me to speak at this most interesting meeting. Your invitation shows admirable broad-mindedness because, last year, I wrote a paper called, "Making Sense of MOOCs, Musings in a Maze of Myth, Paradox and Possibility" that was critical of the MOOCs bandwagon. And six months later, despite the media's feverish enthusiasm for MOOCS, I remain a skeptic.

So these remarks will pose the question: MOOCS, what lies beyond the trough of disillusionment? I start by giving MIT a blanket exemption from many of the critical comments that I will make about MOOCs, and this is not just being polite to my hosts. MIT are the good guys because, in fact, as you just heard, ever since you launched your OpenCourseWare initiative back in the late 1990s, MIT's engagement with online learning has been part of a long-term strategy to master this potentially disruptive technology for the benefit of your campus students, and that is laudable. I shall return to the bottom part of this slide later.

Now the flock of institutions that have followed MIT down the MOOCs route have not shown the same level of strategic thinking. For most, it seems to be opportunism, "me-too-ism", or merely confusion about what online learning is. There is a herd instinct here. And since the subject is MOOCs, cows are more appropriately onomatopoeia than sheep.

So MOOCs: what lies beyond the trough of disillusionment? First, I shall recall a little history. You will find that tiresome, because innovators always like to believe that theirs is the only map to the buried treasure. But on the other hand, as George Santayana said, "Those who do not remember the past are condemned to repeat it." And indeed, I began my MOOCs paper last year with the famous quote about Freudian-ism from the psychologist, Hans Eysenck, who said, "What is new is not true and what is true is not new."

Second, I shall explore two models that must be standard fare for undergraduate courses here at MIT, namely Moore's technology adoption cycle and Gartner's technology hype cycle. Few areas are more faddish than educational technology. So the question is, where will MOOCs go after they slide down from the peak of inflated expectations?

Third, picking up on MIT's 15-year-old assumption that online learning is a disruptive technology, I shall speculate about how universities will use online learning as a routine part of their teaching that includes student support and credible assessment for credit. Call this the plateau of productivity in the technology hype cycle. Finally, I shall ask whether traversing the MOOCs maze will lead us to this happy point. Might MOOCs be, at best, a distraction, or at worst a fad, that will actually harm the cause of open, distance, and online learning?

So first, a little history. The older folk among you will remember the moon landing on 20th of July, 1969 and the famous line, "That's one small step for a man, one giant leap for mankind." You do not remember and were not aware that, three days later, on 23rd July, 1969, the Open University held it's inaugural charter ceremony. The chancellor, Lord Geoffrey Crowther, articulated the university's mission that endures to this day, "Open as to people, open as to places, open as to methods, and open as to ideas." At the time, this radical, large-scale innovation in higher education made the same kind of hit with the media that MOOCs did last year. Many countries soon jumped in, establishing open universities of their own. And indeed, new distance teaching universities are still being created today.

In the 1990s, I wrote a book about those open universities that achieved respectable scale, which I defined as over 100,000 students taking degree-level programs at a distance. There were 11 such universities in 1995, with an aggregate enrollment of nearly 3 million. Today, there must be nearly 30 mega universities with total enrollments of well over 10 million. And that count includes only the open universities. Today, it is practically impossible to count the total number of students learning at a distance worldwide, if you include distance courses offered by campus universities. But the number is very large. We know, for example, that fully a quarter of all university students in India are studying at a distance.

So what are the key points for my history lesson? Just two. First, attempts to take higher education to scale are not new. Moreover, unlike MOOCs, which are mostly study material and self-assessment quizzes, usually without access to degrees, the open universities offer full-degree programs with student support and institutionally-controlled assessment. Some open universities do it better than others. But those that do it well, do it brilliantly. I take as an example the UK Open University, which now has over a quarter of a million students. The Open University ranked number five in England's aggregated assessments of national teaching quality by discipline, one place above my alma mater, Oxford.

Now this slide is dated simply because, in 2004, the presidents of Britain's elite universities, who hated this type of ranking based on teaching, successfully petitioned

Prime Minister Blair to stop it. However, England's annual national assessment of how satisfied students are with their universities was not so strangled. This year, the Open University came first and has never ranked lower than third. It is surely remarkable that a distance teaching university with a quarter of a million students can give its students a better experience than elite campuses claiming to offer tender, loving care and a thrilling intellectual environment. I conclude that the universities offering MOOCs are short on ambition. It is possible to offer degree study at scale and do it well. Mass enrollments and quality degrees can go together.

My second historical point is that MOOCs may be evolving in ways that obstruct the development of open education. That is the view of George Siemens, who was involved in the world's first MOOC back in 2008. And again, I exempt MIT from this criticism. MIT lead the world into OpenCourseWare, leading directly to the UNESCO forum in 2002, which coined the term, "open educational resources" for materials that may be freely accessed, reused, modified and shared. To celebrate the 10th anniversary of that event, a World Congress on Open Educational Resources was held in Paris last year. And it's approved by acclamation, a declaration that governments and others should encourage the development of OER in every way possible, which included, with a final statement urging governments to encourage the open licensing of material produced with public funds. The Congress also commissioned a survey on government policies on OER around the world and a text on the business case for OER.

So thanks to MIT's pioneering work, OER are developing nicely, and governments are using them to widen access to education at lower cost. Just one example is my home province of British Columbia, Canada, which is offering students free open textbooks online for the 40 most popular post-secondary courses. Now many people, and I think of Martin Bean, the current Vice-Chancellor of the Open University, present MOOCs as a further step in the evolution of OER. But in his upcoming keynote to the International Council for Open and Distance Learning Conference in China, George Siemens questions this in a paper entitled, "How MOOCs are Derailing Open Education." His speech points out, quote, "The original MOOCs," like yours at MIT, "were 'open' in two respects."

First, they were open to enrollment of students from outside the hosting university. That is open, as in "open registration." And second, the materials of the course were licensed using Creative Commons licences, so their materials could be re-mixed and reused by others. That is open, as in "open license." Siemens continues, "The new cohort of MOOCs are distinct from the original MOOCs in that they are 'open' thus far, in only one aspect, they are open enrollment. The new MOOCs have not yet openly licensed their courses." And he adds, "As MOOCs continue to develop course content and experiment with various business models, we think it's crucial that they consider adopting open licenses as a default on their digital education offerings. In general, the value proposition is enhanced for the new MOOCs and their users if the MOOCs openly license their courses."

I turn now to the technology adoption cycle and the technology hype cycle. These must be well known to you. Regarding the technology adoption cycle, we can ask two questions about MOOCs. First, will there be a gap between the early adopters and the rest? We can't answer this question yet, because there are 10,000 universities in the world. And, so far, fewer than 100 are offering MOOCs.

The second and more important question is, will most universities decide to offer MOOCs? Is this a must-have technology for universities as mobile phones are for people? And that brings me to the hype cycle. To judge by the number of invitations that I receive about MOOCs, we are now sitting on the peak of inflated expectations. My friend and fellow panelist who will be talking in a moment forecasts that we shall sit on this peak for the rest of 2013, before sliding into the trough of disillusionment as evaluations come in and even the institutions with the deepest pockets begin to ask what MOOCs are doing for their bottom line. The important questions are, how will the slope of enlightenment lead us out of the trough and what a plateau of productivity for MOOCs will look like.

So let me now shift focus and apply these cycles to online learning and teaching in regular degree programs. As regards the technology adoption cycle, we have seen a steady rise in the adoption of online teaching. It has been slow. And many online courses have been mediocre. But there have been few hiccups or retreats and certainly no chasm. And in his yearly survey of the scene, Professor Tony Bates considers that this is the year when online learning comes of age. This maturation is helped along by the likelihood that nearly all institutions will gradually move much of their regular teaching online either as purely online courses, or as a hybrid of face-to-face and online.

Why will they do this? Four important reasons: that the student body is changing; that students are choosing online in ever larger numbers; that institutions threatened by reduced state grants and the bursting of the tuition fees bubble simply must get their costs down; and, finally, and most importantly, as we were hearing from Sanjay just now, when we finally master it, online learning may prove more effective than lecturing.

So if we imagine a hype cycle for online regular learning, it would be unlike the one we had earlier and might look more like this. There were certainly inflated expectations, although nothing like MOOCs. But in this case, there is a sense in the academy that there is no alternative. So institutions, students and faculty are climbing a steeper slope of enlightenment with determination. The plateau of productivity is still in the distance. But institutions realize that they must reach it. So the key question is which way should we head through the MOOCs maze?

Will the current expansion of MOOCs offerings help the development of online learning as a regular method of offering undergraduate and graduate degree programs? Or will it cause the image and the reality of open distance and online learning to regress? Again, it is too early to say. But what are the factors in play? There is good news and bad news on several fronts. The first potentially good news is that the excited press coverage of MOOCs has created a greater public awareness of open distance and online learning, at least among people with an interest in higher education. If Harvard and London are doing it, it must be OK.

However, this could become bad news, as people discover that very few people complete MOOCs successfully. And even those who succeed do not get credit. Further possible good news is that we finally have a new pedagogy in higher education to augment or replace the millennial tradition of lecturing. But this requires that MOOCs faculty work at refining their online pedagogy as a mainstream activity, rather than as a public relations sideline. Cynics see the little videos that are a standard feature of many MOOCs as massage for faculty megalomania, rather than a serious aid to student learning.

Institutions that make a serious commitment to MOOCs will, of course, improve their performance, which is good news. However, while the commercial interests that offer MOOCs have a business model, there is no obvious business model for the institutions themselves. Attempts to monetize internet activity usually degrade the user experience. Copyrighting MOOCs content, rather than making it available as open education resources, is a good example.

These upsides and downsides bring us back to the fundamental contradiction of MOOCs, which is the tension between offering these so-called courses openly and recruiting regular students selectively. To use a final farm analogy from my late colleague, Dan Coldeway, elite universities admit students on the venerable principle of good little piggies in make good bacon out.

The key to getting a degree from elite institutions – and I went to two of them – is to get admitted. Call it a system of difficult in, easy out. For such institutions to adopt the opposite Open University principal, easy in, difficult out, and to get serious about helping large numbers of their MOOCs students to get credit would require a tremendous paradigm shift. And I conclude that offering MOOCs is not the best route to developing an institutional strategy to offer regular degree programs online with student support and assessment for credit. That is a separate challenge and must be tackled as such. MOOCs will not bring you to that destination.

Here, I declare an interest, just as various companies, such as Coursera, edX and FutureLearn, are helping institutions offer MOOCs, others are assisting institutions with the wider challenge of offering regular degree programs online. I'm a senior adviser to one of them, Academic Partnerships, which has enjoyed considerable success here in the US and is now spreading its wings abroad. That company's aim is to help their partner universities lead students into online award-bearing programs and have them graduate at rates at least as good as their fellow students on campus. The company offers institutions a range of services in pursuit of this goal: help with course conversion; provision of a technology platform, if they don't have one; student recruitment; and the organization of student support.

As a service to all those contemplating offering regular programs online or doing so already, Academic Partnerships published last week, in both English and Chinese, “A Guide to Quality in Online Learning.” And it was issued under Creative Commons CC-BY-SA license, so you could do whatever you like with it. Hard copies of the English version are available free at this conference, and both versions are downloadable online. However, I don't think we catered for 300 delegates, so please only take one copy, if you want to take this guide.

I was very proud to be part of the international team that developed this guide, which draws on examples of online learning practice from all over the world. Structured as 16 frequently asked questions, it summarizes the key quality issues in online education in a concise and accessible manner, with an annotated reading list and an extensive bibliography to help you pursue particular topics further.

So my title was, “MOOCs, What Lies Beyond the Trough of Disillusionment?” My hope is that we can climb the slope of enlightenment and online learning and reach a plateau of productivity. When we get there, millions of students all over the world will be highly satisfied with their online degree programs. And moreover, institutions will have stopped complaining about lack of resources, because they will once again have a viable business model. Thank you, very much.

The Magic Beyond the MOOCs

Sanjay Sarma
Director of MITx and the MIT Office of Digital Learning

Thank you. Thank you, Dan, and welcome to MIT. Since the sequence of presentations has been reversed, I was actually anticipating Anant's presentation. But you all heard about MOOCs, and I'll let Anant speak when he gets here. So I won't talk about edX, I'll talk about something else.

Now, as you know, there's a lot of excitement about MOOCs. Dan talked about it, and we've all talked about it. I'm sure Dick mentioned it. But the question that is often asked is, why is MIT so excited about it? If onlines existed since 1984, and you could argue that correspondence courses were a form of online before we had online. So why are we so excited about it? What I'm going to talk about today is what we consider to be the magic beyond the MOOCs. In other words, what do MOOCs enable that we didn't have that we suddenly have access to today? And that will also give you a sense of why MIT is so excited about this whole endeavor.

So universities have existed for a long time. You know, the Western university traces its roots to 1088 with the University of Bologna. And by the way, this is what lectures look like in 1308. Does that look familiar? I mean, standing here, right? So the reason we're here and the reason edX exists is because surely something's got to change in, let's say, 1,000 years. Right? We've had our disruptive technologies in education. We had the blackboard in 1801. Before that, we had the printing press in 1450. So something's going to change given that we've had two innovations, really, in 1,000 years. And Anant will talk about edX, but I'll talk about all the other stuff.

So let me start by clarifying the difference between MITx and edX. edX is, to us, the platform. It is the theater. And to us, MITx is the content that goes on the platform, that goes on the theater. So in other words, we're like Disney. edX is like the movie theater company, AMC or Lowe's or something like that. So we produce the content. We play it on edX. And it plays as long as we want it to play, then we pull it out. Harvard is Pixar or they're Universal. They produce content. They play it on edX. They withdraw. So this is how we clarify. The ultimate goal for edX is to become the place, the global theater, where courses play and the world population take courses. But that's for the world, and obviously that's an extraordinarily important thing. But what is in it for MIT? So that's what I'm going to talk about for the next few minutes.

So we believe that online education fundamentally enhances the magic of the campus. And we have no illusions about this magic. We believe that lectures are great and lectures are wonderful, but the magic happens in places we tend not to look and in interactions we tend not to note or record. Now, already, organically, this has lead to an organic uptake of edX within our campus. So for example, already we have more than 10 courses using the edX platform, not for global consumption but for internal consumption within MIT. And we voted. In fact, and my own colleagues at MIT are surprised to hear this, but in spring 2013 – and Ike may have mentioned this yesterday – we had more than 10 residential courses using the edX platform and using MITx material on campus. And we had more than 1,200 users, students, using this software on campus as a part of their day-to-day existence, day-to-day studies in courses.

So why are we doing this? The reason is we were curious, at some level, what makes our students and the students at other universities so special? What is it? Why is it that someone becomes a Nobel laureate, someone who becomes a star who starts a company, or the leader of a country? How does this happen? The reason, to put it very simply, is the special thing that happens in interpersonal conversations, mentorship, and interactions. And there are many, many, many examples of this. But one example is our very own Professor David Pritchard who was a professor at MIT and an eminent physicist and also an eminent, in his last 5, 10 years, education researcher. In fact, started a company on education technology.

Now, Dave is extraordinary because he mentored not one, not two, but five Nobel laureates. Five. Right? I'll list them for you. These are all great names: Bill Phillips; Steven Chu, who just retired as Secretary of Energy in the US government; Carl Weiman, the famous physicist who himself has become a great proponent of modern techniques for improving education; Eric Cornell; and Wolfgang Ketterle, who is also a professor here today. By the way, Wolfgang Ketterle, when he received his Nobel Prize he came home, came back to MIT, walked to his neighbor's office, Professor Pritchard, and gave it to him. OK. That is the special magic that happens outside this format of delivering information. And the magic occurs in all the nooks and crannies of MIT. If you walk down the Infinite Corridor, you see students talking to each other, professors talking to each other, people high fiving.

If you walk into a lab, as you all, as educators, know, it happens in these sidebar conversations. We have the expression, the water cooler conversations, the back of the envelope, the back of the napkin conversations. It could be, for example, in a discussion. This is the Electric Vehicle Club at MIT. I just took pictures from MIT, but it happens around the world. That is the Infinite Corridor, [INAUDIBLE] labs. That is a robot lab. That's not a student, by the way, that's a robot. Our students do tend to look like that, but that's only before exams.

But this is something that we never record. This is something informal. We take it for granted, right? What we take formally is this stuff. And so over the last 20, 30 years, we recognized this needs to be taken seriously. And there are more examples. This is a teaching lab. And so over the years, MIT slowly morphed, and other schools have morphed. Eric Mazur at Harvard's been talking about it for more than a decade about getting students more engaged in learning, getting them to build things, do projects. So when we came to this realization, it wasn't instant. It's, as I said, a progression. We realized that what we also need to do is figure out how to distill and deliver this magic. Because we, against our better instincts as scientists, we only like what we can measure. But this is immeasurable and unmeasurable. But we, against our better instincts, have accepted it. And we've decided that we are going to do it and do it right.

So some historical things. So in 1969, MIT created a new entity called the Experimental Studies Group. And ESG consists of small interactive classes, problem-solving sessions, discussion-oriented seminars. There's a hammock in the ESG space. Students live together. It's almost like a Montessori school. So we did this in 1969. In 1970, we launched yet another extraordinary innovation, which is Concourse. This was founded, amongst others, by Professor Larry Bucciarelli. And this was an effort to bring engineering education and liberal arts education closer together, and it focuses on science and the humanities. It consists of lunches, seminars, very different. And they have their own tutors, their own lecturers, and a very different education experience. And we have many instructors here who are involved both in ESG and in Concourse.

And then in the late '90s, we launched yet another grand foray, a fairly famous one into engaged learning, and that is TEAL. That is the Technology Enhanced Learning Environment, and it's based on interactive learning. In fact, I think you were in the TEAL classroom, those of you who were with Ike yesterday, on Sunday, you were in the TEAL classroom. And Ike would have shown you this picture. That's how the TEAL classroom looks. It doesn't look like this. That's the point. Right? It's much more engaged and interactive.

Over the last five to 10 years, the word "flipping" the classroom has become, I think, a very nice way to explain what we're trying to do, which is get away from one-on-one lectures and go to interactive lectures. That term, I believe, was invented by Sal Khan, who was a commencement speaker here a couple years ago and, of course, MIT alum. So at MIT, going back to the late 1990s, we've been using automatic tutors to enhance the in-class experience. And I want to clarify the difference, and Anant can talk more about it, between automatic tutors and online. Online is still human intensive. What happens with an automatic tutor is you get automatic grading. And as Anant will explain, in edX you have automatic grading. You have fora. You have all sorts of other – of course, short videos. I'll talk about them a little bit more.

But what automatic tutoring did was it was the first step in being able to flip the classroom pretty significantly. Because now you could get students to watch videos and narrative PowerPoints, and then see if they understood the material, not only for yourself as a professor, but for the students' own good, before they entered the classroom. So now, in the classroom, with the confidence that the students had actually understood stuff, you could lift the level of the conversation. So I just want to clarify. There's a difference between online education and what is happening today, which is automatic grading, which is a pretty fundamental breakthrough. All right.

So again, in the last 10 years, we've started flipping more and more classrooms. Many of them were done before edX, but now, as I showed you, more and more professors are organically using edX because of this desire, this tide, to do more and more in the classroom and to relegate some of the most routine stuff online. And so there's a whole bunch of classes. And this fall, fall of 2013, Professor Michael Cima is going to be doing a very interesting class where we will be using the edX platform to flip 3.091, which is a chemistry class, and it's a very elaborate experiment. By the way, this spring, 14.73 and 14.73x, we did another experiment, where not only did we teach the worldwide class – this was a class with Professor Esther Duflo – we simultaneously taught the class at MIT so that our students could interact with the worldwide blog. The focus of the class was on global poverty, and to have this very rich discussion occur on the blogs was a very interesting experience.

So you can see that our urge to improve what happens on campus has driven a lot of what we're doing here. And this is a message that – I've shown you MIT examples – but this is a message that is resonating worldwide. As I said, Eric Mazur of Harvard gets a lot of credit for it. There are folks at Stanford, Berkeley, great schools around the world who are thinking about this more and more. I was recently talking to Professor Nam Suh, who retired as the president of KAIST, and they've done the same thing at KAIST. Extraordinary movement in education. I'm sure you're familiar with it, but I just wanted to peg it and say that's the reason we really got into this.

Now, there are deep pedagogical reasons for taking this approach. I want to spend a few minutes talking about it. You could say that we're doing it because it's convenient, but it isn't. So let's explore that a little bit. And there's a wonderful paper by three authors from Australia. It's a review paper – Glance, Forsey, and Riley. And I found it about a month ago, and I recommend it. It's called "The Pedagogical Foundations of MOOCs." What it does is it takes what MOOCs do, Massive Open Online Courses, and it takes every element of MOOCs and looks at the education research that supports it. And again, a great paper.

So the first is online delivery. Now, there is a lot of literature that shows that online delivery is effective delivery. There are downsides to it, which I can explain in a second. The downside is the affect. The upside is the cognition. In other words, students learn better online, but they don't feel as good about it. Interesting. What it means is that the community experience is needed to give them the stamina to keep doing it, to keep taking the next class, to stay in the class, and so on. But in fact, the learning outcomes are quite good online. In fact, you could argue, if you look at a range of studies, generally better than in class. And there are many reasons for it. You can scroll back. You can watch the video again, et cetera, et cetera. And then in the edX world and the MOOC world, the peer community helps a lot.

The second is short videos. And again, there's a lot of literature, going back to Richard Mayer, et cetera, et cetera, that says that enhanced attention and focus that comes from these TED style short videos, it's nothing to shake a finger at. The impact is great. Again, students get a bite-size amount of material, and then they can go back, scroll back, and when they get it, they can move on.

The third is online quizzes. And what online quizzes do is give instant feedback. In my class that I taught last semester, feedback would arrive three weeks after the material. Because if I taught a class, the assignment would go out at the end of the week, be returned a week later, and that's when the students received feedback on their doubts, or we found their doubts. But it turns out that if you do it immediately – force students to go back and retrieve information from their short-term memory, it's called retrieval learning – it enhances learning outcomes. So there is, again, a lot of literature on it. Online quizzes is retrieval learning.

And then short videos and quizzes – so if you take a short video and then have a quiz, what it forces students to do is master the material before they move to the next chunk of material, and that has wonderful outcomes. It's more work on mastery learning. Bloom and others have written about it.

And then, finally, online forums, and this is something that Anant can talk more about. It has been a revelation to us. That's David Pritchard, by the way, whom I just spoke about. Hi, David. You were up there a moment ago. Online forums, which enable peer assistance and out-of-band learning. And again, a lot of literature about how peer-to-peer learning – because peers are somewhat more sympathetic, and they understand where the student is coming from – works really well.

So there's a lot of literature for this. So again, I want to say to you that we didn't do this because it's a fad. Well, OK, we did it a little bit because it was a fad. But this was a long time coming. We've been working on this for more than two decades, and this is the final and the natural endpoint of a deep urge within MIT.

Now, there will be a lot of challenges ahead. We have no doubts about that. So for example, there's a lot of fear about MOOCs. Will they cost faculty jobs? And technology moves at the pace of technology. We cannot be King Canute and try and stop a tidal wave with our hands. If edX didn't exist, this would still happen. What edX does is it brings – and I want to say this – unlike other companies which have shareholders, we are trying to bring stakeholders to the table. You, we, we all are stakeholders, right? We can collectively define where things can go with this. In other situations, you have shareholders, and that, to me, is a little bit worrisome.

So one of the reasons edX is not-for-profit is because let's at least figure out where we want to go collectively, and that's why we're so happy to host this conference at MIT. And I'm going to thank Dick Larson for his extraordinary leadership in creating this wonderful community. But I don't think it's going to cost us jobs. I believe that it will more likely change our jobs because it will change the way we interact with students. If a professor is used to coming in and ranting for 90 minutes, as I do, then maybe I need to change the way I interact with students. Maybe I need to learn a new technique.

It's no coincidence to me that the word "lecture" is a little bit – and my daughter said it to me the other day – she said, “Dad, don't lecture me.” Well, it's a little negative, right? Anyway. A lot of words in academia have become negative. If an argument becomes useless, we say it's academic. So we’ve got to reclaim some moral authority here. But having said that, the press on online is pretty extraordinary. This is an article that was written by Kevin Carey for the New America Foundation. He took a class that was taught by a very famous professor, Eric Lander at MIT. Eric Lander is also on President Obama's Council of Advisors on Science and Technology, a very famous guy. He had led the sequencing of the genome and so on.

And I just want to highlight one thing Kevin says. He says, "Live and taped lectures really aren't the same. Live lectures are definitely worse." And by the way, he did his homework. He took the whole class, and he attended the live lectures. OK. So it's a love/hate relationship. He loves Eric's online lectures, but he says the live lectures aren't as good. And he says the burden is on us to figure out what we're going to do with this technology. Again, we are stakeholders. So my suggestion is let's think of this as a challenge for the greater good. And I feel that professors will rise to the challenge. This is what we at MIT at the Office of Digital Learning, Ike and a lot of our colleagues who are here. I see Steve Carson here. This is what we're working towards, is let us see if we can enable professors to grasp this challenge rather than see this as a threat.

And then the hard reality, especially in the United States, is that the price of education, the cost of education, is skyrocketing. The blue line, just to cut to the chase, is income, inflation adjusted. The red lines are all cost of education. So that's another elephant in the room. And, in fact, to those who say that MOOCs will hurt residential education, let me say that MOOCs will actually save residential education by improving, changing fundamentally, the return on investment from residential education.

So the new challenge for all of us, I believe, we all believe here at MIT, is how do we distill and enrich such a wonderful institution, Western education, share education worldwide? It's not really Western education, because if you look at the old universities of Asia, of North Africa, and so on, this is a tradition we have taken that has developed over 3,000 to 4,000 years, and we need to figure out what makes it so special.

And there are a lot of questions. We're somewhat glib in saying we're going to flip the classroom. But what does that mean precisely? What are you actually going to do in the classroom? Are you going to do problem solving? Are you going to do more tutoring as Oxford and Cambridge have done for more than 100 years? Is it going to be problem-based teaching? Do you give the problem at the beginning of the class and solve it? Or do you give the problem at the beginning of the class and have students struggle with it and then give them the solution? We don't have the answers to this.

Daniel Schwartz at Stanford has a wonderful paper that says you better give them the problem, but not the solution at the beginning of the class, letting students struggle and then give them the solution. So we'll have to learn all this stuff in this new world, the magic beyond the MOOCs. Do we do hands-on learning? Do you do field learning? There's all these questions that we'll have to answer in the years ahead.

Final comment is any new technology comes with challenges. And this is what Socrates had to say about a new technology called writing. Right? He said this new technology of writing is going to change pedagogy and learning because students will use writing not to understand, but merely to mimic what someone else thought. Right? That's the essence of his statement. And by the way, the irony of this is we know this because it got written down. So I'll stop there. Well, thank you very much, and it's a great pleasure to be here.

How To Make MOOCS Really Effective:
Lessons from 20 Years of Research into Online Learning

Tony Bates
Tony Bates Associates Ltd, Research Associate with Contact North, Ontario’s Distance Education & Training Network

Well, good morning, everybody. It's a great pleasure and privilege to be here. I'm being very impertinent coming to an organization that is fundamentally research based suggesting that we can make MOOCs more effective by looking at some of the research that's already been done in the past rather than in the future.

Quick overview of what I want to talk about. I will speak very briefly about the differences between open learning, online learning, and MOOCs. But I will talk a little bit about standards, quality standards, in online learning and the tension between best practice and innovation. I then want to look at three basics of online learning: the pedagogy, the learner support, and the costs. And I would like to take those three areas and suggest how MOOCs could be made better by focusing on some of the previous research that has been done in this area.

Sir John really gave a much better overview of the history than I can. But we've had 40 years, at least, of open universities. We've had 25 years of online learning. I taught my first online course at the Open University in 1989 before the World Wide Web. New Jersey Institute of Technology, in fact, was the first institution. The first faculty were Murray Turoff and Roxanne Hiltz in 1979, and they had a kind of blended version of online learning. The other important point is that there are over 50 journals which focus on research into online learning, so there is a mass of literature out there.

MOOCs are various designs, but most of them have been primarily driven by computer scientists, computer scientists who've led the charge in many ways. Created the platform as computer scientists, as you'd expect, but also have brought computer science views of teaching and learning, which is often not shared by many people on the education side. And I want to talk about that gap as well.

And often – and I'm excluding MIT and edX here – but looking at many of the other MOOCs, it's quite clear that pedagogical research has often been ignored in the design of those courses, and in particular, the emphasis on recorded lectures and particularly 50-minute lectures. And I'll talk a little bit more about that.

First of all, let me talk about quality standards. This is from my own website. I have a list of about 20 different quality standards for online learning in different countries, and they cover different sectors. They cover high school. They cover universities. They cover corporate training. So there's usually quality standards in each sector.

These are based on experience and research on what works and what doesn't in online learning. They're all quite similar. They're what I will call "input focused." They look at what you have to do for a good online course, what the steps you have to go through to get a good quality online course. They're focused on the processes of getting good courses, like having instructional designers working with faculty, for instance. But these are often unknown or ignored by many instructors who begin to teach online. So there is a big gap between the theory, if you like, and the practice here.

I want to say a little thing about standards. Standards are based on common processes. These are processes that are shared by everybody who's doing an online course. They are tried and true. But they must only operate in similar kinds of contexts. Now, the first innovative step is a unique process initially. It's risky, and it operates often in new contexts. And MOOCs, of course, are very much an innovation in that sense. They have, in a way, jumped over all the previous work on online learning and done something very different.

Now, as most engineers know, innovation and standards start to come together. So once you do the jump into innovation, you find some things work and some things don't, and you start looking back at where the standards were and try to bring those closer together. And I'm suggesting that at MOOCs now, we're at that stage where that big leap has been made, but now we should be pulling back a little bit and looking at some of the standards and what ones work and what ones don't work for MOOCs.

So here's the challenge for me for MOOCs. The good (more goods than bads, as you will see): easy to access, minimal cost to learners, extremely high quality content so far because they're coming from the elite Ivy League universities mainly, massive numbers. And to me, with sort of 40 years experience of working with technology in education, they remind me very much of great educational broadcasting. In fact, an advance on educational broadcasting because they provide feedback.

But they're like the History Channel. You don't watch all the programs. If you have an interest you watch something, you learn something. Nobody expects you to take an exam at the end of it, and you walk away with something very valuable, and that's good.

The bad is, as we see: the massive non-completion rates, usually under 10%, often under 5%, and difficulties with accreditation. And it can be argued that we shouldn't worry about that. If we see them as a form of educational, open broadcasting, then don't mess about with them. They work very well.

The Future of Virtual Universities

Patricio López del Puerto
President of the Virtual University of the Tecnológico de Monterrey
Monterrey, Mexico

Thank you very much. Being the speaker after lunch is not an easy task. It reminds me of this faculty member that was teaching a class after lunch to a group of students, and one of the students fell asleep. And he asked the student next to him, could you please wake him up? And he said, “With all due respect, Professor, you put him to sleep. You wake him up.” I hope that I will not put any of you to sleep this afternoon, and if you do, I will not ask anyone next to you to wake you up.

I'm going to talk very briefly, because I think that the most important thing is the panel. I want to talk about what I see for the future of virtual universities. I will give you a little bit of background. I come from a private institution in Mexico called Monterrey Tec System. It's called actually Monterrey Institute of Technology. It's another MIT. Now, this is in Mexico. We have been there for 70 years this year, and we've grown. This was our main campus in 1943. This is our main campus now. So we have grown very rapidly in this 60 years. This is just one campus. We have about 60 campuses around the country, and we grew from one institution to 40 institutions, which now have different names. One is related to health, which is that TECSalud. It's a new university system. And we developed this TECVirtual University, which is what I'm going to be addressing a little bit today.

This is just one fast chart about the numbers that we have. The most important number is last one. We provide about 15 million online training hours per year – fully online, only online. And that's the scope of what we are doing. We have corporate programs, and we have graduate degree programs. We have about 12,000 students taking a graduate program with us from all over the world – mainly from Latin America because our teaching is done 95% in Spanish.

In terms of our model, I won't stop here very much. It's probably similar to what any other online university has. We are building learning communities, supported-- this is online, not MOOCs – supported by an academic community, faculty members, and educational specialists, and tutors that support students' interaction. It's very heavily based on student interaction. We are very far from the type of MOOC that we have been discussing this morning. All of this, of course, is supported by a series of learning resources that we have developed in these past 20 or so years of learning. And some education technologies, we are all familiar with those in this room probably more than I do, and this is supported by a technological platform. I think that this graphic sets up what our model is, and it's the only thing I'm going to say. Most of you immediately understand what type of institution we are.

In terms of the courses that we produce, as I said, we produce a little bit more than 2,000 courses per year on the different levels – continuing education, high school, undergraduate, graduate programs, and we're beginning to produce e-books to compliment some of the courses, online or the face-to-face courses, at the university that we have.

Now, let me focus on what I have been invited to talk mainly about – about the future of virtual universities. I'm going to talk from the context of Latin America, the context of Mexico, but many of these remarks may be equally valid for other places and other latitudes and for other socioeconomical levels around the world. I see the future of trying to focus on a new skills, developing new skills in the students-- new markets, trying to get into new markets. I will not get into that. And, of course, making use of the new technologies that are available and that we have been discussing and addressing during this morning and during most of the meetings that we have had.

In terms of the new skills, what I see is that we have not been able with our distance education program, with our online programs, to develop many of the skills that our employees request from our students. Some of these skills, actually, are not even developed in the face-to-face courses, I have to admit. However, we are taking great steps in trying to incorporate these skills into all our face-to-face courses, all our curriculum. The challenge is, how do we develop these same skills in the online courses?

We try to adapt what is being done in the face-to-face – to develop these type of skills. But many of those are developed through a lot of teacher interaction – teacher-student interaction. Most of them are not developed in the classroom. I agree with what was said this morning about how the face-to-face classroom or campus has a role to play. And I think that a lot of that role has to do with the type of skills that we are not consciously developing. We need to do something to develop them consciously and go beyond the material itself, which is the marketing or computer science or engineering, and try to force our faculty to consciously develop or put activities or homeworks or lectures that force the students to develop these types of skills.

So this is a challenge that I think we need to address, and I will very briefly touch on how we are hoping to this into the future. In terms of new technologies, well, I think we have heard over and over that there is a tsunami coming in education and in technologies. I think that we're just beginning to see that that tsunami is reaching probably faster in the developed countries like the United States, but nevertheless is coming at a very first pace, as well, into developing countries. And we have the need to take those into consideration. When you see from our perspective in Mexico what's going on, we read about this, read about the tsunamis, read articles on what's going and see a lot of new developments of what we’ve called this new Web 2.0. We'll also see that the investment is being done in university or online or in general. In education, technology is growing very rapidly.

So this is going to change how things are done in terms of online education in Latin America. We are having also a lot of influence from foreign universities that were not able to come to Latin America or to Mexico because of physical restrictions in terms of you have to go be at the campus and hire faculty and do all this and comply with the government regulations wasn't easy. It wasn't an easy decision. However, arriving online is very, very easy. You just put the web page which your courses – it could be in English or Spanish, and then you can very easily reach. And there is an appetite for fancy – well, not fancy, but prestigious university names for the degrees that our students in Mexico are taking.

So the difference from them to take a course from iUniversity or from MIT or Harvard or Stanford, this place is very high. So they're being tempted more and more to take these courses, especially the ones that follow courses in English, of course, which is not uncommon, especially in a certain level of the population in Mexico. We also see that there's a future there, and we don't know what will be specifically in this future – what 3.0 will be. But, of course, there are things that we are beginning to look into on how to incorporate all of these new platforms, these new techniques, the new software, hardware available into the academic content or into the online courses.

We have very few courses that make use of – even on Facebook or Wikipedia or Twitter as part of their courses, or conferences. For example, I think it's very interesting that we are having a Twitter going on during this conference. That is something that we usually don't see in an academic course, at least not in the ones that we provide for our students. And those are some names that now begin, like cryptic names that we sometimes don't know what they do, but we know that they are getting into the education – all this kind of Khan Academy and TED and all these companies. Of course edX is one of them, along with other institutions. We have Coursera. It's also there.

We are even having a new way of presenting the material to the students. We have new ways of using textbooks. All the traditional written material in textbooks is now available electronically, and all of these companies already have very heavy textbook material developed online or for using in tablets or Kindles or whatever you have available for the students. So we don't have the problem of distributing textbooks as it was before, especially for students which were far apart in other countries or in other cities within Latin America, within Mexico. Everything can be available electronically now, even the textbook distribution system.

We still think is only the tip of the iceberg. There is a lot coming up. And we're beginning to see how fast this is moving, it’s coming pretty, pretty, fast, and we will have to be very careful on how we pay attention to the developments that are taking place around the world. Of course, there are new hardwares coming up. But more interesting is new software. And something that we have not done and we think it's important to do is to bring the big data and analytics to higher education. We know what these companies that their logos are on the screen are doing to collect information about us.

We just follow a discussion that you have here in the United States about the collection of information by the government or these companies. But we know that there is a lot, and when you ask people from marketing – people from Google or Facebook or Netflix, any of these – about what they can learn from their customers, it's a tremendous amount of information that they can have. And they know probably more about me than I know myself in terms of my consuming habits. Because I don't realize those are my consuming habits, but they know they are my consuming habits.

Now, with all this technology behind, the question is, what can we learn about our students habits? Their learning capabilities, their learning strategies so we can adopt the courses that we teach to them. I think we can forecast students and courses to see which students are more apt to take a particular course or how they do that. We can provide advice to prevent failures and drop-outs or stoppages, as it was said here this morning. And, of course, I think we can give early warning of a student's problems. My dream is that at the end of a particular course, we will have a lot of information available for the students and for the faculty about the students. So we can adapt the courses to the particular characteristics or requirements. That will come, as a result of that, a level of personalization that we have not seen or we cannot dream of.

We're taking into consideration learning styles, learning speeds, the desired depth of the student, what he wants to take. And, of course, also provide – that this is something that's been requested by industry – diagnose job-related strengths. If I want to have a particular leader for a particular job when they graduate, can you tell me which of your classes is the best for that just by the information that you collected and that you analyzed and that you digest during the process of taking some of the courses.

So this is where we're going. New technologies will be coming up every time, and we'll have all these things to take care and to worry about them in the future. And at the end, I think that we are changing, we are following the evolution of learning from what was originally a very passive learning to a very interactive learning. That is what we are seeing now. So this is, in a nutshell, what we are doing, what we expect, and I'm more than willing to take questions from you. Thank you.

But I think the real challenge is that for many countries there is a shortage. There's a shortage of capacity for higher education. They're looking to see if MOOCs can be of help to them getting qualifications and credit, and I think we could be working more on MOOCs to enable them to give those kinds of qualifications and credit.

Let's look at the course completion rates for credit-based online courses. I take one example here, a Canadian example of Ontario. The Ontario Ministry of Higher Education surveyed all the universities in the province and asked about their completion rates for credit online courses: 500,000 student enrollments in credit online courses in Ontario, 24 universities.

Their completion rates were about 85% to 95%. That was the range for all the universities. They were about 5% below the completion rates for face-to-face classes on average. So they're pretty good. And you would expect, also, to have a slightly lower completion rate because students were often taking the online courses because they couldn't get to campus because they were working part-time, et cetera, et cetera.

If we look at the Open University in Britain when it started with completely open access. Nearly all the students who started in the early days of the Open University would not have qualified for university entrance in the UK. At that time, only 8% of students went on to universities in the UK.

Over a seven-year period, 42% of the students who enrolled in the first years graduated, and that's not very different from the standard graduation rate now of many American universities over seven years. So you can get high numbers of students to qualify for full degrees using online and open learning.

So how could we actually improve the completion rates of MOOCs? I'm going to look at three areas. The first one is pedagogy, and I want to talk about the difference between the transmission of information versus knowledge construction. We know there are problems with lectures. There's a large amount of research on this to show that students don't learn a great deal from lectures. Mostly, learning takes place outside the lecture when they do their homework, and we saw the effect of homework on the students' performance.

The other issue is 21st century skills. We're not just trying to teach students to know stuff, we're trying to get them to do something with that knowledge. Can they apply that knowledge and use that knowledge to solve problems, critical thinking, manage knowledge – increasingly important because their knowledge becomes out of date very quickly, so can they go on managing their access to knowledge – and independent learning? These are really important skills we want to teach our students, and lectures are very bad at developing those kinds of skills.

Sanjay talked about the magic of the campus. The magic of the campus – it's because it focuses on those kinds of skills, and if we miss those out in our online learning then we're shortchanging our students.

The other concept that's really important is that knowledge is not a thing that you dump into somebody's head but is constructed. Let me give you an example of heat. When we're young babies or young children, we understand what hot is when we put a hand on a stove and we burn ourselves. That's a concept of heat. So we get a bit older, we realize you can put numbers on it. Minus 2 degrees is cold, and plus 20 degrees Centigrade is hot as weather goes, unless you're in Regina in Canada when minus 2 degrees is quite warm!

As we get through high school, we realize that heat isn't a thing, it's actually a process. It's a transfer of heat. And obviously, when you get to MIT, you will learn a lot more about heat than you would in a high school. So your knowledge of something is progressively being constructed and changing. and what we want is an education system that allows students to construct their knowledge.

There's been a lot of research on the difference between deep and surface processing done in Sweden by Säljö and Marton back in the 1970s, and since then. Basically, some students just try to get through the exams and learn what they need to do to get through the exams, but they don't fully integrate what they've learned. And often they forget it immediately, they leave that course and go on to another course.

One of the big problems in engineering is that students forget their first and second year maths when they come to need it in the third and fourth year, for instance. That's what would be called "surface processing." If they had deep understanding, that would carry over and be applicable.

Scaffolding is helping students move from the known to the unknown. I'm grossly oversimplifying the Russian psychologist, Vygotsky, that says you can't learn in too big steps. You have to have small steps that allow you to gradually progress. The other thing is that if you're trying to develop skills, then they need practice and they need feedback. We've heard about important feedback, but we also need to provide practice for those skills.

That puts the faculty member in a slightly different role of not transmitting information, providing access to the information, guiding the students on what information they need; but guiding and facilitating them in their knowledge construction. So on a massive scale, knowledge transmission is easy. As we've seen, we can do satellite broadcasting. We can do MOOCs. But the construction and development of knowledge, on a massive scale, is much more difficult. And the reason for that, is the need for learner support, in order to do this.

So this is the second basic of online learning. There is a tremendous amount of research that shows that learners who study online need a lot of support. And they need structured activities – read, collect, research, discuss, evaluate, and do. These activities require evaluation and feedback, and in particular, the instructor's online presence is critical. That means communicating, communicating, communicating with students, which is very difficult to do for one instructor when you've got 100,000 students. So I'm going to come back to that issue as a challenge for MOOCs in a moment.

But in particular, knowledge construction requires mainly qualitative assessment and feedback at a high level of subject expertise. Because if students are constructing knowledge and coming up with their own perceived understanding of the knowledge, they need some kind of discussion with an expert as to whether they're correct or incorrect, or original rather than just repeating what the instructor is saying.

And the third area of research in online learning that I think is really important for MOOCs – and this is particularly important for those of you from institutions here who want to create your own MOOCs who don't have $60 million behind them as Harvard and MIT do – what are the costs of MOOCs? Now, what I've got here is the costs from a fully online masters program offered by the University of British Columbia in Canada.

This is the cost over seven years of a learning management system-based course, not video lectures, and you see how they break out. And the main cost, of course, is course delivery because that's the learner support costs. That's a third of the costs. So the development of the course, actually, is quite small. It's less than 15% of the cost, the actual development of the course. The support of the course that gets students through the exams is two to three times the cost of development. What MOOCs have done is removing, almost completely, that course delivery cost. Now, some have teaching assistants and so on, and so there is a cost there. But their costs are very different, and that could be good, or it could be bad. But you have to understand that for credit programs, the cost factor is very different.

So MOOCs have very high development costs. I don't know what the cost is for edX, but looking at some of the Coursera programs, they're looking at $100,000, which is two to three times the cost of a credit online course of the same length. And I'm not quite sure the reasons for that. It might be because they're using much more highly-paid professors than the other universities, therefore they have to compensate adequately. But they're pretty high, and I think one of the reasons is because of the technology used, which is lecture capture which requires editing. And there's hardware costs involved as well, and there's also the platform costs. Moderate maintenance costs of $30,000, but again, it's still pretty high for me working with credit programs. Low delivery costs, but poor completion rates. So the research question for me is how to improve the completion rates and the quality on a massive scale.

So here are three suggestions offered not in humility, but maybe it should be. First of all, more constructivist approaches. Now this is hard. This is not quite a subject-based thing. Carl Wieman, for instance, who's now teaching at UBC, and he's a former student here, I think, is looking at constructivist approaches to teaching science. So I'm hesitant to say that constructivist approaches work best in humanities and don't work so well in the sciences.

If we're trying to get away from information transmission and into the magic that Sanjay talked about, then we have to look at more constructivist approaches in engineering and teaching as well. Incidentally, on my blog, the blog post that has the most comments, and that's been going on for five years is: "can you teach real engineering at a distance?" And students and professors are still discussing that on my blog after five years. So there's a real challenge here. Can you teach real engineering at a distance?

So in the constructivist approach, students find, evaluate, apply information, and develop high level skills. So faculty are more as teaching consultants, where they define the curriculum and the learning outcomes, oversee the learner support and assessment; but may not necessarily do the assessment themselves. They may set the rubrics, but have the assessment done, perhaps, through computers and so on, and obviously use the peer-to-peer learning and better computer assessments.

When I say better ones, ones that reflect more qualitative thinking such as critical thinking skills. How do you test for originality in a student's response? A student response may be correct, but not marked correctly because it's not within the parameters of the computer marking. Can we design computer-marked assignments so they can look at original responses that could be right, or could they flag them so that a human could look at it and say, yes, that is a good answer?

Another way is improving learner support. Could we increase the faculty online presence? I think the Khan Academy is a good, possible model. What students want to feel is that when they're online, the teacher is there. Now if it's 100,000 or 20 students, they still want to feel that teacher is there. You don't have to be there all the time. You don't have to respond to every student's comment, but if you ever have a discussion forum, and you see a common pattern of student responses and you respond quickly enough, then students really appreciate that.

And one of the things that I like about the Khan Academy approach – the research came on audio cassettes combined with print, originally, at the university back in 1970. It was found that when a professor talked students through the formula on the paper, the students said, it was like having my own personal tutor looking at me over the shoulder as I'm studying. That's what I mean by a learner presence. Now, can we create that learner presence for 100,000 students with the original faculty member, the top Harvard and MIT professor, giving that feeling over the student's shoulder by doing something like the Khan Academy? Like taking out little segments that they know students find difficult and talking them through it as if they're talking to them personally.

So I'm suggesting that, maybe, you could have judicious massive online interventions in discussions and assessments. Don't just leave it to the TAs to do this. Have a look at some of the discussions. You don't have to look at all of them, you can't with 100,000, but take a small sample and see where the students are going with the discussions and then jump in. Could we design the online discussion so that if you typed in one comment, it would go across all the online discussions, for instance?

Greater use of well-trained adjuncts, maybe not TAs because of the need for subject expertise at a fairly high level, but supervised by faculty. Think of teaching like a medical consultant. You have a team of people working for you. You're providing the overview, but you're making sure the people underneath you understand what kind of quality assessment we want.

Could we design a computer model of scaffolding of the kinds of things that enable students to construct knowledge? Now, we can actually sit down and write down most of the things that encourage scaffolding. I mean, for instance, we know that the steps in learning mustn't be too great. Could we measure, when we put our lectures up, whether we're moving too fast for the majority of students or too slowly, for instance? Is there a way to measure that?

The third is to redistribute or rethink the costs of MOOCs. Maybe spend less on development and production. Maybe move away from the video lecture because that's more expensive to tech space. Incidentally, that would work a lot better for students in developing countries and mobile phones as well, because many of them just can't download videos in developing countries. So could we spend more on learner support and less on development?

Should they be free or low cost? Now, I like this one. I was driving around Boston on Sunday. Now, Sunday, parking is free on Sundays, but it's not open. You can drive round and round and round looking for a parking spot. It's free, but it's not open, right? So Stanford found that when they charged a small fee, $50, I think it was, for taking the exam, their completion rates went up. So could you generate some revenues at a low cost that would enable students to get better learner support? If you're thinking of 100,000 students paying, say, $20, maybe for an exam which may be automated, but use that money for learner support, you might get a lot of learner support for that.

Can you outsource learner support with quality controls? And that's beginning to happen in some institutions partnering with edX, like San Jose State, to provide that learner support. So what I'm suggesting is that we identify the quality issues and the high-cost areas and seek quality computer solutions for those high-cost areas of online teaching.

So why not rethink a MOOC to develop skills as well as content: increase learner engagement and activity; increase interaction with and between students; get students to find, analyze, and apply information; and get students to demonstrate learning through multimedia and assess. Have I got one minute?

The Future Direction of Virtual Universities: A Perspective from the African Virtual University

Bakary Diallo
Rector of the African Virtual University
Nairobi, Kenya

Good afternoon, everyone. I would like to thank Dick for inviting me here. I'm very happy to be here. And I think that this is a great forum. I was very happy, actually, when he invited me. Because I can read from my notes on February 20th. I was flying from Schiphol to Montreal, and I start reflecting on the future of virtual universities. And I start writing a piece. So when you invited me to talk about it, I was very happy. So let me just introduce the African Virtual University quickly before we move forward.

I will speak briefly about who we are, what we do, our activities, and focus on the future direction for virtual universities. I will also spend some time to talk about the challenges of access of e-learning in Africa in order for you to understand where I'm going. So AVU is a Pan-African intergovernmental organization. Our charter has been signed by 17 countries and we operate in 30 countries.

We work across language divide, in Francophone, Anglophone, and in English speaking countries. Through the 15 years of existence, AVU trained about 43,000 students. Our headquarters are in Nairobi, Kenya, and we have a regional office in Dakar, Senegal. Our presence in Africa, covers most parts of Africa, although we need to go more in North Africa and in the southern part. But you can see we are in Francophone sites, Anglophone sites, and Lusophone site. So it's a huge organization. But we have a very small office running it from Nairobi and Dakar, Senegal.

Let me just give you a bit of a background of what is happening in Africa in terms of higher education. Africa is now on the pedestal to become the next growth frontier. However, only 6% of school leavers in sub-Saharan Africa enter a tertiary institution. That's a huge problem. And we know that, at least, it takes 12% to 15% of the workforce that need to attend tertiary education in order to sustain economic development. You can see the gap for yourself. We have a huge problem in terms of higher education.

What makes this not easy is that the universities are currently full, and the demand is high. We believe that distance education and e-learning could help. However, this requires appropriate policies and funding, planning and execution, innovation, quality control, research and development, and a vast sensitization campaign.

That's basically what my organization, African Virtual University, is doing across the continent. The challenges of e-learning in Africa are: limited access of connectivity, high cost of connectivity, power disruption, access to computers and other devices, lack of national and institutional policies, lack of human resources, perception that distance education might not offer the same quality as a face-to-face education. But we do have opportunities, and I think that that's what we need to capitalize on.

Access to Internet is getting better and better every day. We set up fiber optics penetration. There is also a huge movement into using alternative sources of policy, and the emergence of mobile technology is an asset. In Africa, basically everyone has a mobile phone. Everyone knows how to operate and use a mobile phone. I think that if we do sound research and development in that way, you can unlock the potential of e-learning. Other good news is that e-learning is growing in Africa. It's a lucrative business. We were told that in 2011, it was a business worth $250 million, and the projection by 2016, that would be multiplied two fold.

So I think something is happening there in terms of distance and e-learning. At AVU, we do alot to address these kinds of challenges. We do a lot of development programs in terms of setting up and upgrading e-learning centers, training of trainers, content development. We are huge in content development. I'll talk about it later. Open education resources, research and development, developing professional courses, professional networks, communities of practice, gender mainstreaming, quality assurance, evaluation, and benchmarking.

This is an example of a distance e-learning center that we have installed in Mozambique in order to cope with the problem of power and Internet. These are hubs that function 24 hours a day. They could help faculty to work easily, and also some students can go there from time-to-time to access. There is a power generator to make sure that we have electricity 24 hours a day. So when I'm asked to talk about the future of e-learning or the future of virtual universities, I think it would be a very different picture from what you can think of here in the United States.

I would like now to talk about a development model. I think everything is in there. So we come up with this. First of all, I would like to just say from my own opinion, transferring higher education from the United States to Africa wouldn't work, or from any part of the world. Because we have our own realities. In any part of the world, when you develop any content, you have some kind of a basis you are developing from – philosophy, context, culture. How would you think that we can just put it somewhere in there, and people will take it, and that will make sense. I think that is a problem.

So what we are focusing rather in doing at AVU is to work with universities in different areas: policy and conceptualization, capacity enhancement, curriculum design development, content development, content review, quality assurance, accreditation, and program delivery. Basically, whatever you want, you can do within your faculty. We do

e-Learning, Tablets, K-12 Education and All That Stuff!

Naveed Malik
Founding Rector of the Virtual University of Pakistan
Lahore, Pakistan

Good afternoon, everyone. Patricio mentioned the difficulty of starting a post-lunch session and I have the honor. A dubious pleasure of wrapping up the post-lunch session. When the topic came up, the future of virtual universities, I was in the process of actually looking at where our own institution was going. I thought that I would build that in as a case study from Pakistan about its own university and its future direction. But perhaps it represents food for thought for everyone here. So I'm not titling my talk as the future of virtual universities and giving you my ideas on that. I'm talking about e-learning, tablets, K-12 education, and all that stuff.

For those of you who are new to the Virtual University of Pakistan, I'll give a very brief introduction and then talk about the state of K-12 education, look at the challenges, talk about technological ideas, and the intervention that we plan. The Virtual University of Pakistan was established in 2002. The idea was to provide high quality, affordable, uniform education across the country. If you looked at the drivers for the development of such a university in Pakistan, we had two major problems.

One was an absolute shortage of capacity in our existing institutions. And the higher education sector was basically serving about 3.5% of the college age cohort. No more. And the other major problem was that we had an absolute shortage of qualified manpower. So you could build brick and mortar institution, but you couldn't staff them. And to build a professor, or to develop a professor, we knew it took like two decades. So we thought that we would use technology and then provide higher education to all aspirants, regardless of where they were located. And also in the process, elevate the quality that was being offered by using the best talent that the country had to offer.

So the basic model of the Virtual University of Pakistan. It initially used broadcast television. We still operate four free-to-air television channels, which are carried by the cable operators. But more and more so we are using the internet for the delivery of video lectures. And then we interact with our students through a comprehensive learning management system. This is our own development. So the internet has a big role. It is the lifeline of the university.

And the assessment is done through proctored examinations. Examination centers that are designated, again, nationwide. So just a brief look at the picture. At the bottom left is where we sit: the virtual university headquarters. We develop the content, we have permanent staff in terms of tutors and academic support. We broadcast and we all support all of our lecture videos on YouTube, on the internet, to our OCW site, but more so through our learning management system. Students can attend from home or they can attend from a campus, which is basically an infrastructure provision place, but they have to do it as per schedule. So the maximum flexibility of the Virtual University of Pakistan is a 24-hour time window. So we are a very formal institution. We're not an open university. And the idea being that if you tape today's lecture, you may be able to answer the quiz tomorrow. That's what we do.

So 10 years down the road, where are we? We have an established presence and this is in the form of these infrastructure campuses in over 120 cities of Pakistan. We have more than 200 active campuses. We called them Virtual campuses because there's no staff there. There is no academic staff. There is, of course, adult management and there's networking people. Or as Vijay would say, “geeks.”

We have 26 of these campuses that are owned and operated by the university, itself. While over 174 are in very thriving public-private partnership. Our enrollment right now stands around 100,000. What does that imply for the higher education sector? As I mentioned earlier, when we started, we were serving about 3.5% of the college-aged cohort. Ten years down the road, it's not just that the Virtual University of Pakistan has been established. There have also been many other conventional institutions that have come up. The current enrollment in Pakistan stands at about 7% of the college-aged cohort – so ages 18 to 23 or 25 – who are actually enrolled in higher education.

So we're still a long way away from where we would like to be. In terms of the country itself, it's down in the noise. We ranked 145 out of 187 countries in the UNDP Human Development Index. We are very unlikely to meet the Millennium Development Goal of universal primary education by 2015. So, whereas, looking at the virtual university, I'd say that we're great at surmounting almost impossible odds and obstacles. We're also great at digging a huge hole, in which we put ourselves, and then we try to climb out of. And I'll come to that in a minute.

So higher education is still serving only 7% of the relevant age group. It is still concentrated in the largest cities only. It is still expensive. Rather, I would say it is *more* expensive. Because there's been an influx of universities in the private sector in Pakistan. And that actually has raised the cost of higher education. And the faculty shortage still exists. Although we've had a very good human resource development program launched by the Higher Education Commission, nonetheless the demand side is outpacing the supply.

Now, I'll switch to the hole that we've dug ourselves in a parallel sector. Having been associated with university education all my life, I would say that the most disappointing day in an academic year is the first day of classes at the university. When we face an audience, which is quiet, and critical, and questioning. And they just sit and they stare at you. You can talk all you want. You can be as energetic as you like, but you do not find a response. And the reason is for the first twelve years of their education, we have made sure that they do not become critical, inquiring individuals. We've always told them to please keep quiet, don't ask, don't question. I'm the sage, listen to me. And suddenly on the first day of classes, the university expects them to be university students. And they're not. So we spend a substantial amount of time in the first year. And we do succeed to some extent, but it would be nice if you could hit the ground running.

I'm going to take the example of our largest province, which is the Punjab. It represents almost 65% of the country. We have 58,000 functional government schools. The public sector still is a major player. We have more than 8.4 million children enrolled in grades 1 plus. We are more than 300,000 teachers. Looking at these statistics, I think it roughly works out to a student-teacher ratio of about 20 something to 1. Very fair, very decent. Looks nice. But look at the population trend. I got these figures out of Wolfram Alpha. And we are roughly adding 3 million new school age people into the system every year. If you think in terms of the requirement on the teacher and the school side, we don't have 3 million exiting the system. But we do have 3 million additional students coming in. And that represents an additional load.

But it would still be all right if we didn't have this, on the other hand, to cope with. The ones that have writing in red, now these are statistics again from the Punjab, and the numbers represent the number of school teachers in the system. The term, metric, actually represents 10 years of education. The FAFSC is actually an acronym for Faculty of Arts or Faculty of Signed Certificate, which represents 12 years of education equivalent to the US high school. If you think about it, there are three red lines in there. Close to 100,000 teachers have only 12 years or less of education.

And they are school teachers. They do have the PTC and the CT on the left. It's the primary teacher's certificate or a certificate of teaching, which is professional education. But they still have 10 to 12 years of formal education only. Which is abysmal. If you look at the other numbers, there are a certain number of graduates, but without any professional education. So they have a Bachelor's or Master's degree. Only the last two lines – it's about one third of the total number – represents teachers who hold a real Bachelor's of Education, in conjunction with a regular Bachelor's or Master's degree.

So we have a teacher retraining problem existing. We need to bring them up to speed, to make them cope with modern technology. So that they're able to deliver better education in the classroom. But don't forget, that we also had an increase in population. So we've got a double whammy staring us in the face. We've got poorly trained teachers in the existing classrooms, and we need to increase the output of our teacher education programs phenomenally. So one of the things that the Virtual University is doing is that we are launching a Bachelor's of Education Honors Program. This is with USAID support. We have a modern curriculum, et cetera.

But traditionally, and this is the other hole that we have dug ourselves into historically, school education has not been the career of choice, ever. It's been the career of last choice. So the left over people. People who were academically low performers or low achievers. They have gone in, so let's be a school teacher. Whereas higher education is slowly getting better, school education is still in a very sad state. So we have a huge growing demand. We have a shortage of properly qualified teachers. Production of teachers is not meeting the demand. And teacher education has quality issues.

All of this sounds very familiar to me. Because these sound like exactly the same problems that we had when we were starting out the virtual university aimed at higher education. So can we do something? What we are planning to do again, is in an e-intervention. Bring technology into the picture and see if it can help. Hopefully it will. And the issues are the justification for this thing. We have a shortage of properly trained teachers, we need to train them quickly. Bring them up to speed. And in large numbers. Use technology.

We have capacity issues in institutions. Or, we cannot provide a quality teacher all over the place, so we'll plan an intervention. I'll come to that in a minute. The whole world is going "e," so why can't we take the e-word into the K-12 education domain? Obviously, it is not a one-size-fits-all perspective. In higher education, I believe that over the past 10 years, we have a fair idea of how to do things. It does not mean that we have conquered the delivery problem. We are constantly innovating and we are looking at what's happening in the world around us.

The morning has been spent talking about MOOCs. If you think of an average freshman class at the Virtual University of Pakistan, we have about 10,000 to 12,000 new students coming in. So a single class, let's say, Introduction to Computing, is a 12,000 student class. So whether we called that a MOOC or a SPOC. Or perhaps it's just a "spook," I don't know, but we've been practicing that. But when we come into K-12, it's not the same thing. We have to look at the age of the children. We have to look at the pedagogical aspects. We have to look at the teaching aspects, the teacher training aspects. So it's a much more complex picture. At the very younger ages, we would probably look at entertainment as the mode of delivering knowledge. In the middle years, it would be discovery. And in the senior years, it could be constructivist approaches. So let's look at the philosophy.

The idea is to get inspiration from everywhere, but it needs to be designed and developed for local conditions. This is something that we learned very early in the virtual university experience. We couldn't pick up a course from outside and then transplant it in the Pakistani landscape. The context was completely different. And for younger children, this problem is a serious one. So you can take the example from anywhere in the world. Take best practices, but always contextualize, localize, bring it into the understandable domain. “The Physics of Donkey Carts” is BLOSSOMS module. It's precisely meant in this context. Look, it is physics, It is Newton's laws, but let me show you something that you have seen in your own real world experience.

Find the development of content, but deliver for free. That has been the virtual university philosophy. We have an OCW site, inspired by the MIT OCW site. It won the Best Site of the Year Award last year. All of our content is there for free for anybody who wishes to learn. It's only when you want to acquire academic credentials that you actually register and pay a fee. Now, I would like to do the same thing for school content. So we would fund the development of content, but then make it an open education resource. There is a movement on crowd sourcing of knowledge or information. We would welcome contribution of content, but we would only publish it under our banner, after moderation or editing, making sure that it conforms to the university's own standards.

Now, this intervention will require a multifaceted skill set on the part of the university. “domain knowledge.” I believe that's easy to conquer. I mean we've already done university-level courses, so asking a domain expert to develop school material should not be that difficult. At least for the higher school classes. The instructional strategy, it probably is going to be domain-specific. I'm sure that teaching science and technology courses requires a different approach as compared to, let's say, teaching English as a second language. We would have to do it differently.

Younger children require a different approach, as compared to young adults. Then there's instructional design. You need content design and writing. You need e-tools and skill sets. You need to do pilot studies and testing. You need to do scale-up and deployment. All of these represent individual challenges. But that's the direction we are headed in. When we talk about tools and skill sets, we're talking on the non-technical side. We're talking communication skills. You have to have good communication skills to get the message across. If the content is written, or web-based, or whatever, it's ebooks. You need to have writing skills, script writing skills, illustration, graphics design, and so on.

You need to have assessment design. And it was thrilling to hear this morning that amongst the open source offerings that are going to come out of the edX experience is going to be automated assessment. Rapid or immediate feedback to students. So we're looking very, very closely at what we've accomplished here. On the technical side, they are all specific tools. HTML5, or web design, scripting, et cetera, which are IT related. And this scripting is not the audio scripting. This is the JavaScript or something like that. But we would like to be platform independent. So that's why I mentioned HTML5. That it should be available on my little Android phone, as well as on my laptop, or my tablet, or my desktop, or whatever device is available.

Videography, if you go in for small videos, which we will. This requires a different type of expertise – professional graphics design. In this context is going to be professional, but influenced by IT. Interactive animations, almost exclusively developed by IT professionals, but then influenced by the graphics people. And then, incremental publishing ideas in terms of pushing updates. And not to mention, not the dreaded, but the as yet unconquered, M-domain. What do we do with these ubiquitous devices that are sitting in our pockets? Again, in Pakistan, the mobile or the cell phone penetration is phenomenal. Every student is getting a device. But we don't know how to harness the power of these devices for the purpose of education yet. I mean it's still not completely understood.

So we should be looking at platforms, browser-based, WiMax, collaborative networks, loads of stuff. These are now the planned projects. We're looking at e-books for school, browser-based, again. With English and Urdo, which is our local national language content. Tablets will be provided free of cost and there would be an incremental charge that will be meant towards content development. So nobody pays for the content. And I can get into the specific model if anybody's interested.

An immediate project that has already started, and this is obviously the low-hanging fruit, we've started with senior high, ao grades 11 and 12. That is right next to university level, and easier to handle. We don't have to worry about very young children. We can worry about automated content. We can worry about technology-based content the students would be able to handle.

The most interesting part is, again, in terms of having a shortage of adequately qualified school teachers, we are planning on using the BLOSSOMS pedagogy. Where the guru on the screen would be doing the basic explanation of concepts, and the person in the class would be doing the drilling, interaction, and the coaching. And if you think about it, by developing high quality content for the screen – which is going to be three to five minutes long, these are not one hour lectures – and then spreading it across the school landscape, you've actually given a huge shot in the arm to the entire school system. And using a learning management system and tablets, et cetera. So where is the Virtual University of Pakistan going? Back to school.

Thank you very much.

that with many universities in many countries, together, in order to build a capacity in terms of distance e-learning. Then we develop the content in different formats to feed our own purpose, and this is online, just like what you have in here. We also use offline devices like DVDs and print. Because not everyone can access the Internet all the time. So you have to use whatever you have at random moments.

In terms of delivery, we have online delivery mode, face-to-face, and blended modes. And the next two boxes are very important. Because these programs that are developed in here will be used by the consortium. Actually right now, we have 38 universities part of our consortium in 27 countries, in degrees, diplomas, and certificates. And we do use e-learning centers, which are classrooms, to support the study. This is basically what we are doing. And when I was asked to talk about the future, I'm thinking of, how can we see this model 10 and 20 years from now? What is going to happen to this model? I will come back to that later.

Open educational resources is one of the best things that I think happened to us. We have some 219 courses that we have online that have been accessed in 201 countries. And we've received three awards in 2001, 2002, and 2003. And I'm saying, the content is developed from Africa, first of all. And they're being using in 201 countries. But this, I think, will inform also what I think the future of universities would be. Currently, we are implementing an important project. It's about $21 million, funded by the African Development Bank. And what we are doing precisely is to use the model I just showed, the AVU consortium program model, to develop programs, OERs, and to make it available to a large number. And we are always focused on increasing the enrollment in higher education.

For our future projects, I think innovation and integration of technology through R&D is one of the areas virtual universities must focus in the future. What we are talking about now – MOOCS – maybe two years down the line, we'll have something else. But I think what is really important for an online university, a virtual university, is its capacity to adapt and observe. And I always give an example of a blender to my colleagues. If you have a blender, what does it need? Whatever you have could go in the blender. It could be a banana and strawberry, it doesn't matter. I think that a virtual university must have this capacity. We are not providing our own degrees, and our government's members are asking us to look into this. Because they think that we have enough experience in Africa to be able to help. This is one of the projects we are doing. And we are currently doing the feasibility study.

I was really fascinated by the debate this morning about the massive open online resources. It was very, very interesting. But as I was sitting in there, I was thinking, how this can help in Africa? We do not just talk because we want to talk. We have problems., and we need to face and solve these problems. So we've been thinking a lot about this. And we are conducting a feasibility study. We don't want to jump into this. Because it's huge. And whatever you are doing in the United States might apply, or not, in Africa. So we really want to know what we are doing.

These are our first observations. The MOOC concept is very, very appealing. It's great. If you can enroll thousands of students, that's like a dream. Something we always want to do. But I liked Tony Bates' presentation this morning when he was talking about spending, I don't know, maybe 30% of the highest cost of developing a MOOC would go to the video. But in Africa, you don't have enough bandwidth to download the videos. So why should we do that? Focusing on courses and not on programs. And that's a problem. Because what we need in Africa is not massive enrollment problems. We need massive enrollment not in courses, but in programs.

I've been dreaming about this concept of MOOCs, massive online programs with low bandwidth platform accreditation in all countries' members, and high completion rate. That would be one of the future I see for MOOCs in Africa and at AVU. And if I come back to this slide, where would MOOCs fits into in here? We don't see MOOCs as a separate program. We would see it as something that would fit in within content production. And be part of our entire system, not only focusing on courses, but focusing on programs. And we could find MOOCs could be one of these in here. And in degree and certificate programs, we may have courses that are MOOCs. And we will have to look at how they should be accredited. The other thing that I think is very, very important, I know someone talked about it this morning, is to adapt OER content to web-based format, full instruction path with peer interactions, instead of focusing only on videos. This is another direction I think that will be important in the context of Africa.

Now, in terms of future direction for virtual universities. I believe that what we are tasked to think 20 years ahead. In 2008, there was a debate. I was asked to talk about the future of e-learning in 2020. So that was 2008. And the question was, what would be the most important topic in 2020? And there was an audience like this. And they had some devices to vote. And I said, content. I didn't win. But I think I'm still right. Because what is happening after that? We have seen the OER, now we are talking about a massive open educational resources. I believe that talking about the future of education depends mostly on the contents.

But we also need to look at globalization. I think that, like I said, one of the future roles of universities is to provide leadership in emerging technologies and innovation practices through research and development. That will be a key factor of survival. If you don't do it, you disappear, from my perspective. Provide massive, relevant, and affordable accredited education and non-formal education. Because in the future, in 10 years from now, 20 years from now, I believe that even in Africa, we will not have this problem of access in terms of Internet or in terms of power, but what we need is the capacity of a university to provide massive education.

The MOOCs could be, if they are utilized the way we know now, probably mostly utilized in the non-formal education. Something that is very, very important in Africa is that people really like their certification. Everything they do, they would like to have a certification. Even workshop, they'll ask for a certificate at the end of the workshop. So education is seen as a means to progress in your job. When we talk about MOOCs, we need to think about this in the African context. I think the universities, especially in the African context, must provide attractive and flexible services. We know that the learners themselves are changing.

I just can't see my son – who is now turning16, and he is always on his cell phone, iPad, texting – we are together, but he's not there, actually. I cannot see him sitting in a classroom and with a professor lecturing him. It's happening now. It's not working. I think that we need to adapt to the new learners, how they are. Universities have to provide attractive and flexible services, capitalize on collaboration and internationalization. I'll come back to this soon. Globally, I think that the future of virtual universities is bright if they can stay in the competition.

Because what I'm thinking is that a virtual university in 10, 20 years from now would be providing education not within a region, but beyond boundaries. What I was writing in February about the future of online universities was perhaps there will be a time where we'll have a big crisis, just like in the airline industry. I don't know when that will be coming. But at universities, we feel like we are safe. We do what we want. We don't care more or less about the need of the learners, most of the time. We have our own way of seeing things. And that may change.

I think that one thing that could be very important for the universities is to focus on sharing resources, open resources, sharing infrastructure to operate beyond borders, cultures, and languages. We might be inspired by the airline alliance, like the Sky Team and Star Alliance. They share their planes. They share their infrastructure. But they are competing, technically. I believe that if we believe that this kind of alliance can work, it means that a virtual university in the United States can collaborate with one in Africa, and collaborate in Asia, so that they can increase access to whatever they are doing. And they will not be able to do that by themselves. I think that the AVU consortium program model that I showed could be futuristic. I would like to thank you for your attention.

Technology in Education Around the World to What Ends?

Fernando Reimers
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Thank you very much for the invitation. I think that this convening that you have organized now for years – bringing people to talk about how it is that we can use technology to reinvent, to improve education, to expand educational opportunities – is very much needed. And we met at one such convening that we organized on the other side of the street a few years ago. What I'd like to do today is to set the stage for what I hope will be a conversation on what it is that technology has achieved globally with an emphasis in the developing world in terms of expanding educational opportunity, and what is the potential that remains, what has not yet been achieved.

So clearly the rapid development of telecommunication and computing technologies over the last two decades has enabled a wide-ranging global expansion of learning opportunities outside of schools and, in a moment, Lucia is going to talk about some of those, as well as supporting formal education. Now assessing the effectiveness of these developments requires, first, clarity about the purposes that they should serve. Now what I will do is describe an evaluative framework to examine technology-enabled education and then illustrate how that framework could help us think about some of these examples.

It's evident that technology has enabled many educational applications globally, including in the developing world. These include opportunities for learning through games, for learning outside schools in ways not directly related to school curriculum, and also opportunities to learn the school curriculum, to complement what schools do. In preparing for this presentation, I looked at about 400 studies that are available in the academic literature that talk about the use of technology in the developing world. And I was not able to document any of them that is an epidemiological study that says what is the prevalence of the use of these technologies even in large countries. I will be sharing in a moment data that I've collected myself in the country of Brazil. But I was hoping to find comparable things, for at least the major countries, to get some sense of to what extent is technology currently integrated in instruction around the world.

Now my reading of this literature and my observations in travels and work in many countries in the developing world suggests that the technology with the largest reach involves television and is not specifically tied to the school curriculum, but clearly supports the development of knowledge and skills. I'm going to focus my presentation on the use of technology to support opportunities to learn the intended school curriculum. One of the earliest uses of such technologies dating back to the 1960s involves radio and television to complement the work of schools. Today, for example, Mexico transmits multiple educational programs through satellite which supplements the curriculum through educational TV channels and uses part of this programming to deliver the secondary school curriculum through a modality that supports local monitors with television programming in rural, marginalized schools.

Also in Mexico, the Instituto Tecnologico de Monterrey – and we have one of the leaders here – a multi-campus university, really pioneered the integration of a series of 30 campi throughout Mexico using technology and realizing that way some of the benefits of scale through the use of early on satellite transmissions of lectures and currently, of course, the internet and online instruction. Beyond on radio and television, more recently, the developments in computers, internet, and mobile phones have opened up multi-faceted opportunities for innovation. Indeed, there is a lot of innovation taking place in the developing world enabled by technology. And you talked about some of those innovations yesterday at this conference.

Some of them include, for example, providing students with access to computing devices or with opportunity to access a computing device for some time, either for the purpose of helping them develop technological literacy or to have them figure out how to use those devices. It's been a long time since the One Laptop Per Child set its bold goal to produce very affordable devices as a way to expand this kind of access. That program, and then the accompanying decline in computer prices in the larger industry, have expanded the number of students who have access to those in schools around the world. Every time I'm travelling somewhere, there is a new president or prime minister who wants to announce One Tablet Per Child in their country.

Another use of these innovations includes supporting instruction with computing and telecommunication technologies as done, for example, with the program to teach science that we have been discussing here, that Dick developed and has pioneered. And has done with a national program to introduce technology in schools in Chile, a program called Enlaces, which was launched about two decades ago. Now more recent applications of this type include the development of learning objects to support instruction, very highly produced learning objects using computer animation, for example, as is done by Educomp in India, a private for-profit firm which develops high-quality lessons supported by animations and simulations that teachers access through a SMART Board.

Similar variations of supporting instruction with SMART Boards that allow teachers access to learning objects on the web or in other resources have been implemented in many education systems. The dramatic decline in computer equipment has allowed innovations such as the prototype currently piloted in Ghana by the Open Learning Exchange, which allows teachers to exchange lesson plans and allows teachers and students access to a library of reading materials using an intranet based on mini-tablets and on a Raspberry Pi computer, which functions as a server of this network.

An extension of these innovations involves allowing students to access learning objects directly as part of their studies in schools or outside. An example is a program implemented by an NGO in India providing students access to mini-lessons presented in DVDs – not on the internet, because there isn't internet in these schools – which students watch in small groups of up to four students, all sharing the same DVD. These lessons pause after short intervals of presentation of content and pose a question to the group of students, which are then to discuss with one another to check for their understanding. If students have any questions, if they can't master the content, they use a mobile phone to call a call center where someone can provide them additional guidance. And the call center calls, in turn, the teacher and provides job-embedded teacher professional development based on the real-time needs from the students.

Another example, of course, of this kind of thing includes the Khan Academy or the MIT Open Learning Initiative 20 years ago, which are examples of open education resources increasingly keyed to curriculum frameworks. I think that for MIT's initiative, it was not until someone had the brilliant idea of developing an interface that connected the AP curriculum of some high school courses to those learning objects that usage of those resources increased exponentially. They became a lot more accessible for students.

Numerous applications have been developed to support teacher professional development and learning communities for teachers and for schools' administrators. They include Teachers TV in Britain, for example. And now, an internet-based resource which presents high-quality teaching practices developed to achieve specific pedagogical goals for a particular content and grade level. So these are micro examples of teaching, of highly produced, high-quality lessons. These video examples, this approach, has been extended to countries such as Thailand using, again, not internet, but using local stations where those lessons are brought in on flash cards, again, to overcome the challenges of access to broadband internet.

Other modalities of technology used to support education involve teacher education through webinars, learning communities, and other forms of distance education enabled by technology. There are large-scale national programs of teacher education in Brazil, for example, which depend principally on online instruction. One of the most active areas of experimentation and innovation these days involves the use of mobile devices. And, in fact, UNESCO's unit for ICT has a very rich catalog of examples on how these are being used around the world.

At the higher education level, there is extensive use of technology. I'd say that if I compare K through 12 and higher ed, it is really at the higher ed that there is more evidence that the industry is being disrupted in any substantive way through the use of technology, more so than the K through 12 level in my judgment. So there's extensive use of technology at higher ed, both to supplement instruction of traditional students, but also to develop hybrid or fully online programs to serve nontraditional students.

So to sum up, there's no question that there's abundant utilization of technology in education at all levels for a variety of purposes, and that such utilization is accelerating exponentially. Not surprising, because this is just mirroring the exponential development in technology itself and the declines in the costs to access such technology.

Now systematic assessment of how technology is used – to what extent, and with what effect – is a lot less prevalent than I would have hoped. And there is an apparent disconnect between the limited evaluation which exists and the continuous development and adoption of technology. Now, in part, this disconnect can be explained by the fact that the rapid development of technology makes findings based on the technologies of the past, which could mean two years ago, of limited use to inform adoption of innovations based on new technologies.

For example, the possibilities of the network based on Raspberry Pi, which I just described, which has been pilot tested by the Open Learning Exchange in Ghana. What they're evaluating has a relatively limited way to use the research based on even similar approaches developed with microcomputers at much greater cost than they have. So the essential questions of any education policy, really, or program, and consequently of the evaluation of those, are basically who should be educated, for what purpose, with what technology, in what way, at what cost, and who should pay. And these six vectors are absolutely interdependent. They form a system. So if you change the position of a technology in one of those vectors – say, cost – the entire equation changes.

So if there is evident and growing use of, and adoption of, technology for education purposes in many schools around the world, it's less evident that such adoption is yet systematically transforming the education enterprise. Now that may be a matter of what time scale one uses to judge that. If we measure change in centuries, or perhaps even decades, there is a fair amount of change. If we use a more compressed time scale, things are changing much more slowly than technology suggests would be possible.

There is no question that, theoretically, technology allows the development of innovations which can be absolutely transformative, disruptive. The examples I have presented are all potentially disruptive. And this is to use Christensen's notion of disruption. They allow the delivery of higher-quality education to an under-served market with a solution that is not excellent, but good enough, at such low cost that increasing adoption should be expected. But I don't see evidence that adoption is taking place at a scale that visibly transforms the functioning of most schools, of the entirety of those systems. I'm going to illustrate these with some data that I collected in the past several months ago in a survey that I administered to a sample of school principals in Brazil.

I've been for the last four years collaborating with a public university in Brazil in the development of a program to develop education leaders. From school principals to other people who work with them, these are people who hold full-time jobs. This is a blended program, 80% of this online. I can tell you that the uses that my colleagues in Brazil make of technology, of actually open resources, are a lot more creative than the uses I have seen in our own community. So that supports the point there is a lot of innovation taking place. This program would have been impossible absent Moodle, which is the basic platform they use to offer these distant courses, for example.

So I asked these principals a few questions to get some sense – and these are 300 principals from five Brazilian states. They all work in public schools. Let's call them typical states. They're not the poorest states in Brazil. They're not the wealthiest states in Brazil. And I wanted to get a sense of how technology is integrated in instruction in their schools. And this is what I found. I apologize that the slides are in Portuguese. The title is at the top. So I asked them, is there are a plan to integrate technology with teaching in your school? Do you have a strategy? And what you find is that 41% of them do have a plan. This is great. But about 60% percent of them don't.

Now this is such an obvious thing to expect of an organization, that if you're going to bring this technology, you put together a little committee that would include faculty and others and say, what are we going to try to accomplish with this technology? How is this going to tie with the instructional mission of this school? And that so many schools, in a country that has made massive investments in technology in school as Brazil has done, that three in five principals report that in their schools there is no strategy is indicative of the point I was making earlier, that we have yet to see the disruption of most schools.

I asked them, is technology used in your school to support student learning? And what you see on the left-hand side, the two columns, is not all – the extreme one – and "pouco" means very little. So in about half of the schools, technology is not used to support student learning. It's used mostly to support administrative functioning of the school. I asked these principals, is technology supporting innovative forms of teaching and learning? And, as we would expect, the number of principals who say very little or not at all increases to 60% here.

I asked them what percentage of the students have frequent access to technology in the school. And, again, 47% of the principals say very little access to technology in the schools. Now this is a country where mobile penetration is over 95%. And so think about the disconnect between the experience of the students outside the school and the experience of the encounter when they come into the school where half of them do not have frequent interaction with technology. Is technology used for a very simple function? I was hoping to see that they were using emails, text messenger systems, something to communicate with parents. It's a big priority in Brazil, developing good relationships or good communication between schools, school communities, and parents. And again 83% of the principals say we don't use it for that purpose.

Are there platforms, learning management systems, used to support course development, the kinds of things that have become fairly widespread at the higher education level? Again, here, over 70% of them do not use any kind of learning management system, course platform, to support instruction. Are technological platforms used to support the work of students? Digital portfolios, for example. 80% report that very rarely do they use that. In your school, are platforms used to support teacher collaboration? Something as simple as a blog, a threaded discussion, Google Docs where people can collaborate. And, again, 75% say no, we don't use such things. Now, remember, these are technologies where the only cost is the cost of accessing the internet. There is no cost to many of these software platforms.

So if I see this happening in Brazil, which is a country where education is on the agenda, has been on the agenda for the last two decades, where the country has made substantial investments in education, including investments in technology and to bring technologies in schools, I think if there's a country one could have expected, a country of a reasonable scale, to see technology disrupt education, it would have been Brazil. This is not a country that has just recently discovered that education was important. So, to some extent, I think this is illustrative of the challenge.

Now if one were to look for specific small-scale innovations, even municipal innovations, there is plenty to celebrate. There are very creative things happening in Brazil. This program to develop school leaders that has been developed largely by a public university in Brazil is, in my mind, a very good practice, both in terms of how to think about providing job-embedded training for people who are in those positions and how to use creatively low-cost technology to make possible a connection between the university and the world of practice. But I don't see similar things on a large scale at the K through 12 level yet.

So what these figures show is that the introduction of technology in schools doesn't appear to follow a design, a clear strategy to transform education. It's an add-on often lacking a clear education vision. There are many obvious missed opportunities in the responses I have just shown you from principals about how technology is being introduced in their schools. The main missed opportunity in my mind is that the vast majority of the innovations supported by technology of which I am aware – and I spent a lot of time reading the catalog developed by UNESCO of all these applications of mobile technologies, which is where I expected to see the greatest breakthroughs – the main missed opportunity is that most of these are focused on improving access or the efficiency of educational institutions in achieving the goals of the past, in teaching the basic literacies, a narrow set of goals when, in fact, these technologies have the potential to help educational institutions achieve a much more ambitious set of goals, a 21st century conception of learning and teaching.

The National Research Council released about a year ago a report that summarizes what we know about 21st century skills and provided a very helpful taxonomy, which I think could inform a framework to both design innovations that can disrupt education and evaluate them. In fact, such framework was used by a group that convened at this university in January, convened by your chancellor and by my colleague Chris Dede, looking at the impact of technology in higher education itself. They were thinking mostly about MOOCs and about higher education largely. And their report was just released. And it did exactly what I'm suggesting. It took the National Academy of Sciences' framework on 21st century skills and said, what would an evaluative approach, informed by those goals for learning, look like?

So I want to show you very quickly what the National Academy does, which is to identify the competencies that matter in the 21st century, in three buckets – cognitive skills, the capacity to work with other people, and the capacity to govern oneself. And for each of those buckets of competencies, there is a body of scientific research based on learning sciences, on psychology developed over the last centuries that could very well inform a deliberate strategy to disrupt education using technology. So what are some of those buckets, basically?

Cognitive skills involve processing and cognitive strategies, knowledge, and creativity. Knowledge is where most of the applications I have seen is currently focused. It's not that knowledge is unimportant. It's that if it is the only thing that we concentrate on, we're going to serve the kids very poorly to have the skills that will allow them to use what they know to solve problems.

Processing and cognitive strategies, the best educational innovations do that. Many large public education systems are still struggling with trying to achieve these at scale. Critical thinking, problem solving, analysis, logical reasoning, interpretation, decision making, and executive functioning – a skill that we know is increasingly important, the ability to organize yourself and to stay on time when you're given 20 minutes for your presentation. I need just one more minute.

Knowledge, this is what most education systems do. Creativity, increasingly, we're paying attention to the capacity. I see in just about every university – certainly in mine, I hope you do it in yours as well, Dick – we have all of these innovations in pedagogy to support new forms of learning for students. Presidential competitions where students are invited to tackle big challenges using what they know in teams. We have created an innovation lab to do that. I teach a course on educational innovation and social entrepreneurship, where the pedagogy is all based on project-based learning – get the students to solve real problems. So this is increasingly receiving attention in some educational institutions.

Interpersonal skills, basically, the capacity to work with other people – fundamental to live in the 21st century – and the capacity to lead others. And modern technologies have given us unprecedented opportunities to help students develop those capacities to work in social networks of other individuals. But I have yet to see at scale examples of innovations designed to do that rather than to help remediate or address the most basic skills. And, lastly, the capacity to govern oneself, to develop the ability to learn, work ethic, and to be self-efficacious.

In my mind, these are the opportunities of the coming decades, to use technologies to create opportunities to develop those skills, to use this approach in engineering those technologies and in evaluating them. But the challenge will continue to be that because technology develops exponentially much faster than we are developing educational applications, and because the costs are also dropping very, very rapidly, research is always going to be playing a catch-up game in generating findings that have some use to inform future programming decisions.

Thank you very much.

Using SABER: A Tool to Apply a Systems Approach for Better Education Results

Robin Horn
Director, Programmes, The Children's Investment Fund Foundation, and former Education Sector Manager for the World Bank's Human Development Network

So, I'm going to take off from Fernando's – one of his major points, and it came up in the questions. It's the issue of why is it that innovations are not being taken up by policymakers, by teachers, by schools, and scaled-up, especially if there's evidence that they're working.

Before I start my presentation, I'm going to step back to talk a few minutes about what it is that people who work in the international community – who are trying to build the quality of education systems to deliver better results, and to get outcomes of learning and some of these other skills that Fernando was pointing out before – not just literacy and numeracy, but all those 21st-century skills. How has the community been working on this? How have organizations like the World Bank or USAID, or the UK government, or NGO's Save the Children, local NGOs, Pratham in India for example.

These are organizations all around the world who are trying to get countries to improve their education systems, so that all children learn. All children become effective adults, and are able to go to higher education, and produce things for their economies, as well as for their families. So it's all the same objective. So the fact is, over the years, in all these communities that I just described, there is a kind of theory of change which is implicit – sometimes explicit for some organizations – which I'm going to describe now.

What I'll do is I'll describe this theory of change. And I'm going to talk about SABER, which is a tool – and I'll describe that – that helps address the issue of take-up, of ownership, of effective interventions and strategies. I'll talk a little bit about the methodology of that. Give an example about the teacher system and interventions to improve teaching, and ultimately learning. And I'll talk about all of this as an open data system. In a sense, that's where we link to technology – but in other ways, as well.

So what is this theory of change that drives billions and billions and billions of dollars of investment over the last 30, 40 years to help countries get better education outcomes and better results? The first step in this theory of change is this idea of identifying the determinants. This is usually done on the basis of theory. Fernando just gave some of the theoretical justifications, the theoretical background for what would matter in developing effective strategies or interventions that could make a difference. It's also done on the basis of observation and experience. Where are things working well? What are the things that might matter there?

Let's pick those out, and let's do some studies. Let's do correlation analysis, regression, and more advanced research, more recently, to figure out what are the factors that make learning happen. How will computers help children learn? How will mobile devices help a teacher be more effective in the classroom?

First, you figure out what it is that makes that happen, and then you develop an intervention around that. And that's the second step. So you figure out this matters. Getting children to have mobile devices that are connected to the internet. This allows them to pull information out of the World Wide Web, and apply it in their classroom, maybe even in a more structured way.

So typical kinds of interventions that are developed might be – based on our research in the US, or at MIT or somewhere – getting children to have computers with learning objects on them, as Fernando was pointing out. Or, teachers using learning objects that that's going to make a difference. And this is how it would work. So you design an intervention. And you get that. You have a number of schools, or a number of institutions, or a number of universities where you try that. And then the expectation is we'll learn from that.

Down the line, we'll figure out what to do with that information that could help schools and universities everywhere in the world. So for example, you come up with some hypotheses, and you develop an intervention. And you test it out. By the way, some of these interventions – many of them – are implemented in settings, which are controlled by the researchers or by the designers of the implementation. For example, an intervention in Zambia to get students to have more textbooks, or an intervention in Guatemala to give parents more power in order to oversee and hold teachers accountable.

You have to make sure that all the conditions are right, and all the pieces of the experiment are in place – that your supervision is done properly, that you have control over the whole intervention – so that you can test whether it's working or not. You're able to figure that out. And there's a lot of science in doing that.

The next step is to evaluate that intervention. And the conclusion of that evaluation might be proof of concept. If you give computers to these students, in this way, and you measure these outcomes. And you make sure that there's a counterfactual. This group didn't get them – randomly assigned – this group got them. Great. And you get a rigorous evaluation, maybe done by J-PAL at MIT, or IPA at New Haven, or other organizations around the world that do rigorous controlled experiments with random controlled trials, sometimes, or discontinuity of regressions. You come up with a rigorous finding. Fantastic.

You have a proof of concept – that if you do this in this certain way, in this particular period of time, with these controls, you get an increase, an effect. Maybe a sixth of a standard deviation of improvement. Wow. You get that effect. Next step is that you go, you take this finding, this rigorously evaluated finding – robust, with an experiment behind it – you go and take it, and you go to policymakers. Go to the minister. You go to the teachers union. You go to other stakeholders. And you say, we have it, we have a solution. This is what you do in this way. And you do that in that way. And you get the result – a fraction of a standard deviation in improvement, or even a half a standard deviation in those few exceptions where the intervention is phenomenal.

Of course the next step, which is the at the end of the theory of change, which is where religion comes in, in some sense. It's where faith comes in that, once you show this to the policymaker, once you show it to government, they say, "I'm going to do this. I'm going to not only take this thing that worked in seven schools or 20 schools, I'm going to take it and put it in all my 400,000 schools in the country. Because this is effective. And I will do it myself."

Well, the problem is that that last step doesn't happen. Or, I should say, it rarely happens. Sometimes it does. Sometimes it doesn't. 95% of the time it doesn't happen. So what's the point? What am I saying? For countries to take on and scale up interventions, first of all, they need to be involved in the process. They need to actually be implementers from the very beginning. Because it's not a proof of concept if it's not implemented by the owners, the implementers, themselves. All it is kind of an isolated controlled experiment that's done by an external group, with external financing, with external supervision And there's no way where that is a step where the next step is country ownership and large-scale expansion and delivery.

So what's missing? And that's what I'm going to be focusing on for the second part of my talk is the policy context, the enabling factors, the enabling conditions for interventions to be taken up, to be owned and delivered by the authorities or by other stakeholders who have the capability of reaching out beyond just a limited intervention. So that you want to see that intervention being viable in the context. You want to be able to know, from the very beginning, if it could be sustained in the system that exists. Dor absorption and expansion, ultimately, you need a set of system metrics to specify and measure the macro parameters that allow you to know, with some advanced knowledge, whether this intervention fits this context and can be absorbed.

Now I'm going to talk about SABER. Some people call it "Sub-air." For example, my colleague from Brazil would say "Sub-air," because it actually stands for System Approach for Better Education Results. That's what SABER stands for, but it also means knowledge in Spanish, Portuguese, and so on. First of all, what does SABER provide? It provides an understanding of what matters most. That's a global "what matters most." It's not just what matters most in this context for this intervention, but what matters most to get interventions dealing with technology, for example, adopted anywhere in the world – rich, or poor, north or south, and so on. Across the key education system domains, the teacher subsystem, the finance subsystem – there are a bunch of different subsystems that make up the education system. What matters most in each of those subsystems?

It provides descriptive data on the policies. And I'll talk about that. And I'll show you what I mean by that. It assesses. It evaluates. It judges what the policies are, whether they're good policies, and ultimately whether they're being implemented. Then there's country ownership and sign-off. They are part of the process. Government is owning this process for measuring system policies. And, finally, it puts it all out there, so countries can learn from one another. So researchers can learn from what countries are doing. And you could learn from the real-world practice.

So the theory of change with SABER in it is a little different than the theory of change that I walked through before. Because it says that these interventions – that are designed in order to test a certain hypothesis, and then evaluate rigorously – have to be designed in a way that are consistent with the policies that are in place in a given country. For example – and the SABER looks at the policies.

For example, if you're working with an intervention that requires that you improve the quality of the system that supports teachers to use technology – I'll stay with these technology examples because it's relevant for this particular audience. But let's say that your goal is that you have a hypothesis. You have a set of theoretical reasons to assess, to design and test an intervention that would use the existing teacher system – to have those teacher's supervisors who are out there in the districts, let's say, to improve the use of technology in the schools, to work with principals, for example.

You have a whole model. It worked great in Berkeley, California. Fantastic. It's beautiful. The system works. The teachers were getting that support, and so on. So let's bring it to Bihar, India. Everything's fine. Except let's say there's no teacher support system in place. There's no policy that says there should be a teacher support system in place. So the implementers say, OK. Well, let's create a little mini teacher support system in this district in Bihar. Then once we get that working, we'll show the state government that, if they only did this – created this whole system, passed laws to put this policy into place – great, then it would work.

So that's an example where you have policies, and you have interventions, and they don't fit. You have an intervention that doesn't fit with that particular policy. So what you need to do is figure out what are the policies, what is the policy framework, what types of reforms, what types of interventions could this particular country support, given its policy framework? Then you can figure out – with the counterparts, with the country – what to do, how to do it.

So what they did with SABER – I call it "Sub-air," sometimes SABER – is look at the policies that, based on the billions of dollars that the World Bank has provided to countries, and the huge amount of research that many of you and others have done all around the world have come to look at.

What are the systems, the subsystems of an education system, whose policies are important for getting good results, and whose policies need to be understood? The policy framework needs to be understood better, so that you can design interventions that could eventually be taken up by the government, by the stakeholders in place. So what we have here, for example, we have policies around learning standards. What is it that students should learn to be able to do? What are the policies? Are they standards-based? Are they just content coverage? And we're able to say some policies make more sense – from the research, from observation and from pure research – than others.

Some of the weaker policy in learning standards would be just a set of coverage topics. Teachers are expected to go through all the topics from the beginning of the year until the end of the year, irrespective of if any of the students are learning anything. So that's not a great policy in learning standards. The other extreme might be standards-based, where there are tools to assess each student, whether that student has mastered that standard. That's more advanced.

So one is kind of latent, or undeveloped. The other extreme is advanced. And you start assessing that. That's learning standards. Financing, teachers, ICT. World Bank is developing policy frameworks for ICT, for health and school feeding, workforce development, ECD, and so on. So all of these things – I'll show you at the end how you get access to all this information.

What are the steps? I'll take you through the steps for SABER. One step is to carry out a state of the evidence review, could be state of the art, but of the evidence. What do we know? What does the evidence tell us? What is the research? Good research – what does it tell us about what matters in developing good learning standards? What matters most in good teacher policy? In addition, there's a lot of research that doesn't exist as Fernando was just saying. There's huge amounts of things that we don't know. There is a lack of research in policy frameworks, and there's also a lack of research in interventions.

So you need to also learn from countries that are performing well. For example, this country seems to be performing very well, according to some international tests and other measures on learning standards, on their learning standards system. Let's see what they're doing, what their standards are. And then we could infer from that what seems to be good learning standard system. Ultimately, I'll describe that you can test that and evaluate that in practice over time.

Next step is we – the team working on that particular subsystem, let's say learning standards or teachers – develops a kind of state-of-the-art book on what matters most in good policy for that topic. We'll call it "what matters," and in that are the metrics for measuring policy.

Until now, until SABER, there were no metrics. There was no way of comparing countries' policies with one another. Each researcher goes to a country, or a state, or a province and brings his or own language, his or her own tools, applies it, and comes up with a report. Maybe gets it published here. Maybe gets it published there. But they're not comparable. So one of the things that's necessary, in order to have consistent knowledge and consistent measures of policies, is to develop these indicators, these metrics. Define them in a crystal clear way, and then apply them in different contexts in different countries.

Then also there's a scoring rubric. So based on the data that's collected, what is OK? What seems to be – from the evidence – what's good? What's great? We call it Latent, Emerging, and up through Established and Advanced – the kind of stages of development. You could also say one, two, three, four. You could also say bad, good, and so on. But we came up with these terms because countries seem to accept them more readily.

Then there are these instruments that collect this policy information. All of this is publicly available, by the way. And I'll show you how you could get that. Analysis of the data. Rating of results. Countries then validate the findings. The ministries of education or finance, depending on the topic, will look at this and say, yeah, this is accurate. This does reflect what we have in place, in terms of our policies. You can go ahead and publish that in your open data.

That's not an easy step, as you can imagine. But countries that are interested in learning what their neighbors are doing, or what their comparative countries are doing, they can't say, I want to see everybody's, but no one can see mine. Because if everybody had that approach, then no one sees anybody's data. So they accept it. They buy into it, just like they do with PISA, those of you who know PISA or TIMSS. And then, this is put out in Open Data, on a knowledge platform database.

Here's what I was talking about – levels of development on the rubric, from Latent, to Emerging, to Established, and Advanced – to show whether this is a policy that's robust or a policy that's weak and needs to be strengthened. And countries could use that to target a particular policy area and develop it further.

So now if I want to give an example of one of the policy areas – one of the domains on teacher policies. In terms of the context for this, until SABER came along, there was scarce data on teacher policies, per se, for developing countries. There were a lot of studies of interventions, a lot of theories out there. But in terms of the policies, there was very little. And there was very uneven evidence of what works and limited guidance on policy decisions.

So that was the problem that SABER teachers tried to address, and then pulling together global data on teacher policies, comparative analysis, opportunities to learn from education systems around the world, and you end up with basically this chart. If you could read it, it says these are the eight policies that, when implemented well-- not necessarily all of them well, in the same place – but when these policies are implemented well, results are better. Outcomes are better.

One of them is setting clear expectations for teachers. Attracting the best qualified people into teaching. Preparing teachers with useful training and experience. I'll stop here. You'll be able to see this later. This all goes on the web. I'll be focusing for a second, with the next slide, on this goal. What does it mean to have a good policy on preparing teachers with useful training and experience? Basically there are two main categories. In the end, it seems very simple. But this is something, looking across the world, across hundreds of studies – what studies exist – and shows that there are basically two factors that you could look at across the world.

Are there are minimum standards for pre-service teaching education programs? And to what extent are teacher entrants expected to be familiar with the classroom? When both of these are in place, then you could say that, at least, it's a reasonably good policy for preparing teachers for effective instruction. So what is the minimum level of education required to become a teacher, for example? And we apply that to primary school teachers and secondary school teachers. And your teacher entrants have opportunities to learn from practice. Again, we look at this separately on these two types. How much experience is needed? And sometimes it might be, in some countries, the experience is zero. You just get theoretical training, and you're off and teaching. They would get Latent on that. In other countries, they have to stop practice a year under supervision. That's high quality. That's at the high end. And that's where you'd have Advanced.

So now, in my closing, I will show you some examples of the website that the World Bank has now, as it exists, recognizing that in a couple of months it will change. They've been investing to make it into a more practical, usable website, so that all researchers, all politicians and policymakers can access these data and use it when they're designing interventions or trying to improve their systems. By the way, there are six of these "What Matters" reports all available, 12 domains in design or under pilot, from teachers to ICT, and so on. But 100 countries have at least one domain, usually multiple domains. And there are a bunch of country reports that have been released by countries.

So I don't know if you can see this. This is from the website. I'll give you the address in a second. This shows, at least on the right-hand side – you scroll down. There are 90 countries there, including some provinces and states in some countries. And the colors indicate – black means the data is already approved by government for release on the Open Data platform; dark blue means it's completed, but not yet signed off by government; and light blue means it's still in the process of data collection or analysis.

Here's an example of the page on teachers. If you look at this, here are the goals on the left. So here, for example, the third one is preparing teachers with useful training and experience. Then you look across – you could scroll across all the maybe 50 or 60 countries that have done this. For example, on the first one, let's say, setting clear expectations for teachers. Egypt on that particular metric, on that indicator, received a score of Advanced, whereas Jamaica, the second one, received a score of Emerging. So then, when the Jamaican authorities look at this, and they say, what do you mean? What's going on in Cuba? What's going on in Brazil?

They're able to compare themselves with other countries that are of interest to them, and say, why is it that Saint Lucia has Advanced in terms of attracting good teachers? And then the report will – I'll show you the report in a second – that will take them through what it is that they're doing, what they could do to improve their policies, and so on. So you could see that. Here's an example of a snapshot of the Country Report that the country gets that they sign off on, that's in the public domain. Here's the front page, which shows, in each of those different goals, what the status is. For example, this is Jamaica. You saw a second ago that it's at Emerging for setting clear expectations for teachers. There's the score there. There's a little text there. And then inside, in the report, you have one page per goal, so it's very accessible.

That's the other thing. It's really important. Information needs to be accessible for the policymakers to understand it, so they could use it. And here's a snapshot of a page. I'm not going to read it, but this is the page on matching teachers' skills with students' needs. You have one page. And then on the right, you see a chart, where Jamaica said, well, these are the countries that we're interested in. We're interested in Mexico, but we're also interested in what the advanced countries are doing. And so we agreed with them. OK, let's show Singapore, Japan, and they could compare themselves with those countries on these measures here.

So in closing, this is the website. I'll leave it up during the question and answer period. We have not quite two minutes for maybe a couple of questions. And then later on, maybe we'll have more time. Thank you.

The State of Technology-Enabled Education Around the World: Canal Futura as an Open Source Experiment

Lúcia Araújo
CEO of Canal Futura, Brazil

Good morning, everybody. First of all, I'd like to thank Richard for this wonderful invitation. I think I'm one of the few people here who is a non-academic. I'm a mere journalist. But I have been lucky enough to run this channel completely devoted and dedicated to education. So it's a pleasure to be here, and a privilege to learn so much from all of you.

So let's talk about Futura. I feel very happy to be surrounded by people who know Brazil and Brazilian education scenarios so well. So maybe they can help me answer the questions afterwards, such difficult questions. First of all, let's browse through some Brazilian data in three specific scenarios – a general scenario, education, and IT scenarios.

For those who are not familiar with the country, people say we are the seventh economy in the world. We have a continental area, almost a continent, and a population of almost 200 million people. I'm mentioning here the nonprofit sector. It's responsible for 5% of GDP, because Futura is a result of the nonprofit sector. This last data is important for what we do, television, because television is loved by Brazilians. It's the second most consumed appliance, just behind the stove and before the fridge!

In terms of the education scenario, we have almost a country population of students enrolled in basic education, 50 million, and almost 2 million teachers. But when you include university teachers and also social educators, who are very popular, who work in grassroots Brazil, we reach almost three million teachers. In Brazil 7.9% of the population is illiterate. But when the calculation includes what we call “technical illiteracy”, this number rises to 20%.

The average years of schooling is around 7.3, whereas in the United States and I think Sweden, around 12 years of schooling. In Brazil 35% of the population have not concluded elementary school. This is for me very impressive and, unfortunately, very sad data. We have 2.5 million youngsters who do not study and do not work.

This is, I think, a national tragedy and we must tackle this subject immediately. For you to have an idea, the other day I was listening to a testimonial of one of these youngsters. He is a dropout and he said, “I have not abandoned school. School has abandoned me.”

It’s very dramatic, and it's true. Because most of the youngsters, they are not interested in school. There is a problem of being interested in school. They feel that school was not for them and that's tragic. Only 39.4% of the population finishes high school. This is a very low number. But you see that the other day, I was looking at other research that said that 62% of the Brazilian population trusts education. They feel education will get better in this next decade. So we count on this very important asset in order to develop our education scenario. Of course, the most vulnerable are the youngsters and the low-income segments and the African population, indigenous peoples, people with disabilities.

In the IT scenario, well, Brazilians love technology, love television, love novelties. We have almost 40% of the population connected to Internet. We reached 100 million wide band connections and 52 million people have access to the Internet on their cell phones. Brazil estimates all these sales in tablets; tablets are the preferred means of navigating the web. Among the poorest 10% percent, only 0.6% has access to the Internet. But this is changing very quickly. And of course, we have still a regional gap. The South and Southeasters are much more covered by Internet connections, and people that are included in this digital world. The Northeast and the North, the Amazon region, are still far behind.

So what is Canal Futura? If I could describe it we are a very strange animal in the television educational TV scenario, we are like a frog. Why? Because, let's say, we operate in the “long tail” and in the “short tail”, still going on the animal metaphor. We are on air, we are broadcast television; and we are on Earth, through outreach initiatives. So this is our “long tail” through which we deliver to specific publics, audiences, specific material in order to make our content used by different groups. We are funded by private foundations and companies. But we have a public nature.

We are a kind of meeting place, a hub for different sectors of society to dialogue. We make TV, but our intention is mainly to make a difference. We are a public concession of educational TV. We were created 15 years ago, and are managed by Roberto Marinho Foundation. For those of you who are not familiar with Brazil, Roberto Marinho was the founder of Global Organizations, which is the fifth largest communication group in Brazil. So they have commercial operations in Futura. We are not maintained by Global. Global TV is one of our funders. We have 11 other companies and foundations.

So there is a kind of consortium, a nonprofit consortium around Futura, funding its operations. So as I told you, we are in the “short tail”, let's say, so we are an open source strategy as every broadcast TV is. In turn, I will here highlight some features of our work. Our content production mode process is completely collaborative. It's cooperation among different sectors of society. As I told you, we dialogue. It's the main word for what we do.

We are connected to more than 30 universities all over Brazil, through which we transmit our programming and we produce content.

For every series we start in Futura, we promote a thematic forum; inviting people from different sectors to dialogue and to tell us what should be tackled in these series. What are the themes that are more urgent? How can we make a difference? How can we be more effective with those contents? And we also co-produce a lot with students and NGOs. For you to have an idea, we are connected to more than 2,000 NGOs all over Brazil. And in terms of reach, we reach nowadays 94 million people. This is our technological coverage. Two million are teachers, and by teachers here I'm talking also about social educators.

In the research, they declare themselves as teachers. Although sometimes, they do not have a pedagogy diploma. But they act in grassroots situations with our material, and helping people organize activities for children, for teachers, and so forth. And from these educators who watch Futura, approximately more than 70% say that they use our contents for either classroom activities or out-of-classroom community activities. Now, we recently researched the profiles of these educators in order to fine tune, let's say, our delivery to the education environment. And the teachers, they declared that Futura is very useful for them to broaden the worldview of their students, to address cross cutting issues, to broaden the students' cultural universe.

Public schools are of course full of children who come from low-income backgrounds. So enriching their cultural universe is something very important, to make education a more rich process. The programs also support them in coping with problems and conflicts in classrooms. Of course, we asked them, how could we improve our contribution? And they say they want more content designed for practice in the classroom, and also to learn and get acquainted to new teaching techniques. We did this research with 2,000 teachers and principals in order to improve our insertion in the education scenario, although we already work in different projects with the Minister of Education, with government, and secretaries of education from different governments.

So now let's see a little bit of this distribution beyond TV. I got to know many different strategies and very sophisticated ones, but we cannot forget also the simple technologies. It's not because they are simple, they are not technology. So we try to assemble all the strategies we can, all the technology we can in order to deliver our material. And when you consider regions so remote as the Amazon, sometimes you cannot count on the broadband. So we need different strategies.

One of the most successful strategies we have is the Futura Suitcase. Futura Suitcase is a kind of thematic organization of our content, for example, the environment. We have a suitcase totally dedicated to environment issues. We do a kind of organization of our best programs on environment. We develop teacher’s guides. We develop suggestions of activities. And we also put together material that comes from referenced institutions.

For example, in our environment suitcase, there is material from Greenpeace, from WWF, from different institutions that are dealing with these subjects on a daily basis. I will show you a small video, a 40 second video. Because last year, we completed 15 years and then we taped some stories of people, teachers and students, who have been connected to Futura along these years. I show you the story of a boy, who is now a professor, but he tells how his relationship with Futura has been.

So this piece is among a collection of 20 pieces that we did with different people who have been using Futura in this “long tail” way. Futuratec, we are the only channel in Brazil to have a video library through which teachers can download and tape our programs. We have more than 750 hours of programming in different themes. Usually television has many copyright issues. They do not allow their programs to be taped. But in general, they are like pirate activities. So we are pirates of ourselves. So the teacher has just to register as a teacher and say what is his institution.

Afterward, we ask him for feedback. How he used that material, what problems he found in that material, what we should do to improve, what would you do? And now, we are starting to change the platform. Because still, it takes quite a long time to download and tape. And I'll talk about that later, how we are going to renew it.

Besides that, we developed teacher's guides for our main programs, for the main series we have on TV. I'll show you some pages only of these guides. They are available on the Internet, also. And this is a very funny series about financial education for youngsters. The name is “Money in Your Pocket.” Here is the teacher's guide where we suggest activities that may be played in the classroom. The show is a game show for youngsters. We do it in partnership with the stock exchange of Sao Paulo, and it's very successful. The World Bank has been with us, watching what we do. We are in the third year of production.

Now the Central Bank of Brazil has recently called us in order to develop a project for financial education for Brazilians who are coming out of poverty. Because what's happening is people are coming out of poverty and are getting to have a lot of debt. They are spending a lot of money. So they want us to develop a project, design it for the low-income people who are starting to get more money and getting out of poverty. It's in Portuguese and here are some of the activities and also information, where they can expand the knowledge they receive from the program.

In addition to that, another technology is Futura Room. Futura Room is equipment that we have built together with communities, inside the communities. For example, in Rio, we had Futura Rooms in 80 favelas. The room is possessed by the community and usually it's a club or it's a school. We provide all these videos, all the content. We train local teachers to use the room, developing activities with children, with students, or even for training teachers. For example, in Favela da Mare, they have a wonderful project for training teachers and they use most of our content to do that. In Brazil, we now have around 18, if I'm not mistaken, 18 Futura Rooms are scattered all over the country.

Now, we are starting also a community on Facebook to improve our relationship with teachers. As I told you, this is a strategy we have, how we can improve our contribution to education, especially to be together with the teachers. We have now 10 beta testers, and our idea is to have an environment of exchange with the teachers. This is a place where they can inform and exchange experience about the use of video in classroom activities, where they can evaluate our programs, where they can give us ideas. It's when Futura listens and not speaks. We want to improve our ears, and not only the way we speak.

We also have a channel on YouTube, a distribution channel for our programs. And we have MIT BLOSSOMS classes. In our partnership, we hired a professor who mirrored the BLOSSOMS classes in our curricula to make the choices. And then we subtitled the classes. They are broadcast very early in the morning, if I'm not mistaken, 5:00 in the morning. But they are available in the Futuratec, and they are available on the Internet.

Now, we are enlarging our menu of classes. Because they are very useful for Brazilian teachers, and also for a youngster like Wendel, like you saw in the video, who are preparing to enter university. Now, this is a documentary we did, just to show you one strategy, where we showed the documentary before on the Internet and showed it one month later on television. And why did we do that?

The documentary, just for you to have an idea, is a very touching documentary about four atypical days in the lives of four convicts from Rio de Janeiro during their temporary leave on Christmas. We had four teams accompanying them and it's incredible. I say that every person who has the small intention of committing a crime, if they see the documentary, gives up. Because really, it's the value of liberty, the value of freedom, and how much they miss when they are imprisoned. This was the result of a pitching process, a public pitching. We do this a lot in Futura. We invite independent producers to show us their ideas, and then we choose one.

We did this exhibition on the Internet. We advised people who are interested in this theme, in public security and human rights, we asked them to watch the documentary and produce opinions that, afterwards, we streamed along with the broadcast. So that in the broadcast, there was already a community that had seen the documentary and that had opinions about the documentary. Then we put everything together in the broadcast.

I brought an example of our contribution, very direct contribution, to the education scenario. And this is a series we did about PISA, about the OCD assessment that assesses the performance of countries. Brazil is the 53rd, although it's getting better. It's improving, but it's still lagging behind. And I was really getting fed up of hearing people comparing Brazil with Korea, with Finland. We should do this, do that. And then I said, well, let's see what these people do. So we went, and we had educators with us, because we are communicators. We needed the educational approach. We needed people who know the situation, what happens, what goes on in schools. So we invited NGOs to go with us to Finland, to Korea, to Canada, to Chile, and to Shanghai in China to check directly what was going on there.

Mostly, we wanted to understand what is the value these societies give to education, and how their policies derived from these values. We wanted to understand this, and see how Futura could support this kind of turning. Because we feel that Brazil still needs to put education in the center of the debate, and we want to give a solid contribution. Because everybody talks about Korea, and nobody went there to see how they made it, and to what extent we should copy them or not, and what should we value in what they did. So we did these documentaries. All of them are led, are conducted by 15 years olds from these different countries and we produced seven documentaries, 50 minutes each.

Of course, we did one about Brazil. Because this would be very useful for discussion, for the debate. Our intention was really to foster the debates, to give a contribution. We produced 2,000 kits like this, printed material about PISA and about the countries, and also the DVDs. And we delivered them for pedagogy courses. Now we are collecting the results of different professors in different universities that have been using this material for enhancing the debate inside the classroom. So we are now trying to do the second series about the countries that did better in the last few years, although they are not top of the rank. But still, they are doing, they're investing their effort in order to change their position in this achievement.

Brazil has a big challenge that is education. I always say that we cannot to be the seventh or the sixth economy in the world without education. There is no wealth that can be sustained without education. So this is really very urgent for the country.

We at Futura have our own challenges and they are:

- The digital conversion of our archives. We have done this for the last two years, but we have still 13 years behind us. We need to put everything digital so that we can make everything available, more and more.

- The digital conversion of our signal. The Minister of Communication set up a schedule through which in two years, we must be digital. Of course, that's wonderful. But it will demand a lot of money, and we have a very short budget.

- The update of an institutional site for use as a portal. We are on the way toward doing that. Because we have many different initiatives on the Internet and we want to assemble everything under only one umbrella.

- As I told you, with Futuratec, we are migrating from BitTorrent to VOD. We want to create virtual schools, where virtual content is directly associated to learning. We want to develop implementation guides. By this I mean that we are now in the process of crossing our series of programs with the curricula so that we can make more direct recommendations for how teachers of the specific subjects can use our material.

- We have to update and empower the teams to meet the educational challenges. That means that I have to train my team to be more effective in the education priorities.

- Review the channel's operational model. Of course, empowering much more new forms of content use and distribution.

- We have now many pilots of e-Books and Apps where we are transferring what we did in the programs for these new models of production and distribution.

Well, that's all. And I'm here, available for your questions. Thank you very much. Thank you, Richard.

Where TEE is Today and Where it is Going Over in 5-20 yrs: Old Wine in a New Bottle?

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I will talk about this topic. And there are three subtitles: the policies for ICT in education, and understanding MOOC, and challenges for MOOC in Korea. Look at this. I do not expect you to read this picture. This is the ICT policies in education for Korea. Now this whole thing came from the inaugural ceremony in 1998. The president, former President Kim Dae Jung, announced a big policy for ICT in education, saying that Koreans will be the best people who can use computers in the world, without discussing it with the Ministry of Education.

So this is what happened. The budget, of course, first of all, the budget for the Ministry of Education has to go up, in order to provide that policy. And Korea is still technically in the war. You remember that, last month, we were threatened by North Korea? That means that we have to have a strong Ministry of Defense. So usually, when the Ministry of Defense gets the most money, we don't complain. But during this time, we complained that the Ministry of Education should be the first.

As you all know, Korea became the high-performance country in PISA study. So the PISA study not only we are strong country in the latest PISA from 2009. That study is conducted every three years. So the new one will come soon. But in the last few PISA studies, Korea has been very strong. So this is, again, the results of our performance in PISA during the 2003, 2006, and 2009. And we've been always number one or two, except science. Science is number six. So what made this country, Korea, a high-performing country? Korea invests big budget for education: 8% of GDP goes for education. That includes formal education and informal education. And that's the number one in the world.

And the social culture, that comes from a long history. We believe that our endeavor – not family background and wealth of the family – but the endeavor that makes the social class change. So education is very important. And the social culture supports higher education very much.

And we have very highly competent teachers. The best students come to the education department. School of education gets the highest score students, of course, except school of medicine. But except that, most of the time, the school of education gets the smartest students. And the student teachers, most of them have master's degree, some have PhDs. And they are highly paid. And socially, teaching job is recognized as one of the best jobs in the society. So in the wedding market, we call it market, people with a teaching job have a very good ranking.

Now this is important. Educational policy to support teachers were embedded in the Ministry of Education, and one very strong policy is ICT. Every teacher has got ICT support, software, hardware, network. The whole school gets the infrastructure of ICT for education. And we believe that investing education money to teachers is the best way of using education money. And we had to fight over the policy priority, whether we should spend money first for reducing the class size, or providing the teacher support ICT facilities. And we won. Don't you clap?

So there are various policies for ICT in education. We have a big organization called, KERIS, which is Korea Education Resource Information System, that takes care of ICT in education in the nation. And this is the home page, and there are many policies to support ICT in education. This is just some of it. I want to show you some of the programs that Korea is using to support education through technology, ICT. We have an education broadcasting called EBS, Education Broadcasting System, 100% devoted for educational programs. They have beautiful documentaries, beautiful programs for education. The videos are divided into smaller video clips, less than 10 minutes, sometimes one or two minutes. And they are classified by themes, classified by the curriculum, so that all the videos produced by the Broadcasting System are all stored in a video clip which can be used for teachers for the classroom use. And this is the page of EDRB, Educational Digital Resource Bank. So according to the film, teachers can go in and select the video clip easily and use in the classroom.

The second policy that I want to share with you is the SMART education. SMART education is to transform our education system. Although we have high-performing students in PISA, actually, we were shocked that we were at the very top. We didn't believe that our education system is that good. So we always want to transform, update our education system. We always work on education innovation. And this is one of the methods that we are using to transform our education.

We believe that our next generation should have a different sets of skills. Like you just said, we need different 21st century skills. With the current education system, we cannot provide such skills to students. So this is how we want to do it. Before, 3R plus ACT. And now, 3R, ICT and media literacy and more 21st century core competencies embedded in the curriculum. So those teachers will get training for their 21st century competencies. The students will get different sets of literacy levels. So through that SMART education project, it has five sub-projects, and eTextbook is one of them.

eTextbook is just a textbook for Korean subjects – math subjects and English subjects for primary and junior high schools. The eBook cannot be produced for high school students where their first target is to get into the university entrance exam, and that is too risky to implement this new approach. I think Korea is the only country in the world where people will go to work one hour late on the day when students take the SAT, because students have to have an absolute quiet environment to take the English test to hearing, listening, speaking. So no airplanes, no cars. I mean, cars OK, but no airplanes. Very serious business. So we cannot make any mistake in providing eBook for their university entrance exam.

And Edunet is another portal, another national educational portal. Through Edunet, students and teachers share instructional materials and instructional activities. Teachers who work in this space are called "cyber teacher." The ministry hired the volunteers from schools, and teachers work as a teacher to students in this cyberspace. Another system is called NEIS: National Education Information System. This is administrative national system to support teacher's daily work. So this NEIS will support the service for teachers and parents, and home education service, and online recruitment, and score qualifying examinations – all kinds of administrative work. And this is the page for NEIS. Without NEIS now, teachers cannot function. When it was embedded first, the teacher's union had huge resistance. In fact, that was the first time in the world that this kind of system can raise a human rights problem. Teachers think this system will invade their personal information, so they show huge resistance. And because of that resistance, the government had to change the minister. That was really serious. We have many serious events in ICT in education.

And now, I go for higher education. KOCW – sorry that we copied the name from MIT OCW – this is Korean OCW. So the lectures from universities load their videos. Up until now, 4,746 lectures were uploaded, and the course materials – immense. And a lot of other foreign OER associations are part of this KOCW, so those Korean students get access to OER through these portals, and this is the first page.

And our universities are called cyber universities. Now this is different from Open University. Cyber universities are regular universities, but all the instructions are done through cyberspace. Now we have 21 cyber universities. Some regular campus-based universities own the cyber university as well. But some are purely independent cyber universities. So through these cyber universities, people at work can study at their own time at their own speed. And we have a lot of ODA projects, and Asian Cyber University is one of the ODA by the government for education. This is governments' initiation, Korean present to the Asian countries. This contract was made during the summit meeting in 2009. So this cyber university – online university for Asian countries – will start to open from next year.

Now all these policies look glamorous, but I have to say that we are in here. During the last presidential regime, the Ministry of ICT was gone. And the budget support for ICT policies were reduced. And people do not trust anymore that ICT can meet their rosy promises. I think we are here. I hope, so that we can catch up. From this present, new ministry for ICT came back. So I hope, next year, I can report that we are here.

So what have we learned from these policies? We learned that teachers are the most precious, most important agency to conduct these policies. And a lot of education research shows that education cannot be done without teacher support. So teacher's acceptance, teacher's support, that's the best way to make your innovation work in the field. And we had bottom-up approaches, and a lot of top-down approaches. We learned, by now, that the bottom-up approach is important, as important as top-down approach or even more so. Now we went through a cycle that we learned that top-down approach is no longer valid. Without the understanding, without the acceptance from the field, teachers, administrators and students, that innovation cannot work.

And we need to accept that the start is always slow. We get very impatient to see the result when you invest, particularly, lots of effort and money. But it's always a slow pickup. So you have to understand that it's slow, but it will come. You should have trust that it will come. Parents are as important stakeholders as students. We have to treat parents very importantly. A lot of times, important decisions are made by parents, not teachers, not students, not administrators. So you have to take parents' opinion, their voice, seriously in new innovation. And education should come first. And then technology can support it. When you introduce your new ICT policy, don't show that word, "technology," in the front. Then people get really upset and say, no, no, no.

Now education transformation is agreeable in a general level. But when it comes to a more detailed level, a lot of disputes, a lot of battles, a lot of discussions. So you have to expect that. And then, sometimes, because of that discussion for the details, the general agreement for the education transformation will be gone. And quality comes from quantity. When Korea tried to provide education for all as a policy in the nation, we started with primary school. Some nations start with higher education, because higher education can produce the elite who can lead the country. But we started from the bottom, elementary schools. And then we invested the middle school and high schoolm and the higher education came the last.

Now through these all education transformation approaches, we want to have different sets of new approach. We want to show that some new approach can really make a transformation in education. And I believe that that can be MOOCs. So what is MOOC? Normally, e-learning systems consist of three elements: contents, and LMS instructional activities, and then management. Now MOOC has contents and LMS. But I cannot see management. It's mixed. It's not easy to find all those elements. And I'm not sure whether it should have it or it shouldn't.

A lot of people say MOOCs will be the true engine to make the change in education, will be a true disruptive engine. Now tuition is free, which may not be true next year. And massive numbers of students, this characteristic has lots of potential and lots of beauties. Now massive numbers of students can make beautiful learning communities. Interaction is always active, 24 hours active. And the immediate feedback is always possible. Now we all know that immediate feedback is so important in education. So we trust that this massive number will make the true, unique contribution of MOOCs to be a disruptive agent for education.

And mastery-based, personalized learning, this is one of the promises that MOOCs say they can deliver. But it will take time. And just-in-time learning, that's, again, a very important aspects of MOOC. I am struggling to understand what role MOOCs can play in scores for informal education. So I tried to make an analogy of e-learning system to school system. MOOCs are a part of e-learning system. So as usual, I classified the elements of e-learning – contents, LMS and management – into the school elements.

The contents can be textbook. If it's a textbook, who pays for textbook? Sometimes, the schools pay. But usually, students will pay. So the contents in MOOC, if students are asked to pay, this will be a natural thing to do. Now LMS. This LMS includes instructional activities. And this is a platform where students and teachers do their feedback and interactive activities. Now, if this part requires a fee, if this is the situation in school, do you think students will pay for this? It's a unique role of teachers. So of course, students won't pay. School will pay. Schools will pay salary to the professors to do the interactivity with the students. So this role from platform cannot be charged to students. Now management, this a school operation. This is to maintain the credits and the entrance and give the degrees and so on. Now this, students can pay for tuition for this service. This is not clear what to do.

Now contents and LMS, those two are elements of what's going on in the classroom. So school – which is management in learning system – can be a combination of lots of these kinds of classrooms. So this is one classroom, and collection of these classrooms will make a school. And then the school should have a management function.

I am still confused about MOOCs, and the roles. And the fee is to come from where? And how these models can be applied in campus-based universities.

The lack of MOOC model for campus-based university is a task that we have to serve now. They are the minor users among MOOC users. But they are the important element in making sense of this MOOC model. Let's go back to this. Now I made this model, based on the MIT model. Now this MITx is a content development center. So that belongs to MIT. Now the platform, edX, can be used for many, many universities. So their use can be part of MIT, but they are not part of the MIT system.

Now the management of these contents and platform can be done by somebody else. That OEIT, I think, is taking a role of management in this MOOC system. Now will MIT get content from other universities? From other platforms? If so, then how is the tuition or management to be done? I'm not sure. So I am proposing some challenges. This is not for the whole scope of MOOCs – but that's more from a perspective of pedagogy.

Now accessibility, that will be still a problem. Now a lot of people for MOOCs are from many countries, but the majority of users of MOOCs are from USA. This is the number of students who have access to the MOOC. Now this is a quiz for you. I need your interaction feedback. Which ones belong to the same category? Number one, two round cylinders. And number two, two brown figures? Now raise your hand, if you think number one is the answer. Raise your hand, if one is the answer. Please, everybody. OK. Number two? Please raise your hand. OK. This shows the cultural differences. This is for Western people. And this is for the Asian people. You're all Asian people. And this, again, is a cultural difference. So if you classify this picture of a Monkey, a Panda and a banana by animals, that's Western people. And if you classify this by these two [a monkey and a banana], that's Asians.

This is a very famous psychology study done by the Michigan people. And languages, again, very different. Western people tend to use nouns more. And Eastern, meaning Asia – the CJK, China, Japan, Korea – is verb-oriented language, because we think everything is connected. So when you say "More tea?" in English, we say, "Do you want to drink more?" So this is just a small example of cultural differences. And I do not know what to do with these differences. But what I want to say is that cultural difference has to be embedded as part of the pedagogy for e-learning. OK. I think I will stop. Thank you.

MIT BLOSSOMS: International Co-creation and Co-utilization of Math and Science Video Lessons for High School STEM Classes

M. Elizabeth Murray
Project Manager, BLOSSOMS Program

Well first, I want to welcome you all, and I want to especially welcome those of you who submitted papers to the conference, because I had extensive communication with each of you. And many of you I've talked to, but I hope that those of you that I haven't talked to would come up to me and say hello, because I really like to match a face with the name. So again, welcome.

So we're going to be talking today about BLOSSOMS, and one thing that we're really proud of about BLOSSOMS is that it is international co-creation and co-utilization, and we'll get into that. So BLOSSOMS stands for “blended learning open source science or math studies,” and it is a project of LINC. It grew out of LINC, out of one of these LINC conferences, which I'll tell you about later. But we don't really use that long name. We just use the name BLOSSOMS, because we like to think of this as a program that helps a love of math and science to blossom in students.

So what is BLOSSOMS? BLOSSOMS is math and science video lessons created by gifted volunteer educators from around the world. And here are many of our gifted educators from around the world. It's a free online library of interactive video lessons for high school math and science classes. And I'll explain what we mean by interactive. These are not boring videos that students sit and watch in the classroom and fall asleep, but instead they're actively engaged. The students are actively engaged in a learning experience with a virtual teacher whose home classroom might be a world away.

What we call interactive is something we call the "Teaching Duet" pedagogy. BLOSSOMS lessons are designed to be used in short spurts. For example, the first segment, we would like it to be just two minutes-- the first video segment with the guest lecturer, the guest teacher. The first two segments are just supposed to be exciting and engaging and pulling the students into the lesson. And then the teacher, the classroom teacher, stops the video and then she engages with the students in the class. Perhaps they're problem-based lessons, perhaps they're collaborative activities, but really challenging activities that have been designed by the video teacher for that particular break.

And once those activities have been done and the learning objective has been achieved, the teacher can turn the video back on. There might be up to five or six segments in all in a 50 minute lesson. But all of the other segments are never more than four minutes long and then the teacher stops, and again he or she does more challenging activities in class with the students. And this is how it goes. It's an iterative process. And the last segment of all of these videos is a video teacher guide, which is a conversation between the video teacher and the classroom teacher who may use it to explain why he or she created the lesson, what they hope the students will get out of the lesson, and also suggestions as to how the lesson could be taught, how the activities in the breaks would be used, and there are a lot of other supportive materials.

So the focus of the BLOSSOMS lessons is not on memorization or rote learning, but on developing critical and creative thinking skills. We're trying to develop those 21st century skills of problem solving, collaboratively working together. We try. It's not easy, as we heard this morning. It's not easy to really know exactly how, but we're trying to challenge students. We don't want them always to feel that they have to have the answer. We want them to be thinking and approaching the problems from different angles, and so that's what we're trying to do.

Let's see. OK, this is our website. I just thought I'd quickly show you the BLOSSOMS website. This is the BLOSSOMS website, and we have a video library of over 100 video lessons in this library – math, biology, physics, chemistry, and engineering. And this is the library. You would go to a specific page and you get all of this material, and every one has a summary.

I want to show you that this area for teachers has all the handouts that you would need for the lesson, anything that the teacher would need to actually do the lesson in the class. We provide a long list of additional online resources. Most importantly, you can see over here that every lesson comes with a complete written transcript in the native language of the lesson – for example, in English – and so this facilitates translation. Faten will tell you about how they used our English – they were able to subtitle into English the lessons that they made in Saudi Arabia, and it's the transcripts that make that the easiest. I just wanted to point out – I don't know, some of you might recognize this woman. Sandra Haupt – is she here today? Oh, there she is. This lesson just went up onto the website, and she is a teacher in Concord, Massachusetts, who won a national contest that we had last fall to make a lesson, and so congratulations.

What I want to show you now is a very quick and kind of jazzy video of a lesson actually being used in a classroom. It was used in a high school in Arlington, Massachusetts, by a math teacher, and it will just give you a feel for how these are actually used.

> HIGH SCHOOL TEACHER: This is going to be exploring the probability that three sticks made out of this one long stick – we'll call that unit one, if you will. If you break it at two random points, what's the probability that the three sticks will

form a triangle? And then we'll move on to seeing the video that was made by one of my colleagues at MIT. The program is called BLOSSOMS. Now notice, this can be done in a very poor region. You can shift the video via computer anywhere in the world instantly with virtually no expense.

DICK LARSON: My name is Dick Larson and I'm a teacher at MIT here in Cambridge, Massachusetts, USA. I hope you're feeling fine today and full of energy.

HIGH SCHOOL TEACHER: Are you?

DICK LARSON: We have an interesting challenge, a problem for you that's going to build on the math skills that your teacher and you have been working on these past few weeks, and maybe months. Today's problem deals with triangles, and if you're currently in a geometry class in high school, that's sometimes called the science of triangles and so it's not inappropriate for us to study triangles, but we'll be doing it in a different way.

HIGH SCHOOL TEACHER: So our first job is to take any length and, of course, we don't have to break it in 1 through 36. You can break it through 1 through 100.

STUDENT 1: That was the one that we got and then we subtracted these two to get the--

STUDENT 2: To get the second one--

HIGH SCHOOL TEACHER: Second one in the middle. Good.

STUDENT 3: The two sides combined have to be greater than or equal to.

DICK LARSON: And they're all mixed up, and they're going to select two at random, and they're numbered 1 to 36. Let me pick out the first one here. He reaches in, he pulls out – ah – it is a 24.

STUDENT 4: This doesn't form a triangle. These three don't form a triangle.

HIGH SCHOOL TEACHER: So if we did this experiment over and over again, what percent of the times do you think that the two randomly selected numbers would result in being able to make a triangle?

DICK LARSON: Go with 24 and then I have to cut through at 10. OK. Gentleman, we have the three pieces so obtained. And let's ask the question, can we form a triangle with these three pieces? Well, look.

HIGH SCHOOL TEACHER: What is the probability that the first digits of the two numbers will be the same?

I can see I'm running out of time, so I think I have to move on. So I quickly want to show you-- you've seen this before. This was the conference in 2005, the LINC Conference. And that actually was where BLOSSOMS was born, because we had a professor from the Gaza who came here to talk about how they needed distance education in the Gaza because so often the university students couldn't even get to their classes because of roadblocks and stoppages. After he spoke, there were a lot of people from the Middle East who jumped up, including people from Israel and seven or eight other countries – in fact, Naveed, you were there – and they got together for dinner and breakfast, and they decided that they wanted to work on a cross border project with the countries working together. They decided that the level they wanted to focus in on was high school math and science, because they were all university professors and they felt that when they were getting into the colleges, into the university, the students were really weak in math and science.

So we started that. It was called the Middle East Project at the time. We never really got it funded, but the idea stayed in our heads. And then we were doing some research on distance education in Mexico and also China, and we came across this class in China where there was a very, very poor school. But the teacher would have lecturers coming in from Tsinghua University, and the students were really very involved with this and watching, and what she'd do is turn the video off and turn it on. And we thought, well, what if you design videos that were designed to be turned on and off? And so that's kind of where we got that idea. Also in our research that we did in Mexico, we discovered a lot of high school teachers are not comfortable with the computers and that technology, and so that was another contribution, too.

So why do we need an initiative like MIT BLOSSOMS? We're all affected by globalization, and our children, they need an education that enables them to find jobs in this new economy. We live in a Knowledge Age. Things have changed so much. The wealth of a nation is not like oil and coal, but the most valuable natural resources of a country lie buried between the ears of its citizens.

So within this framework, BLOSSOMS began with four guiding principles: improve math and science teaching and learning at the secondary level; introduce teachers in a gentle way to the power of technology-enabled education; encourage universities to reach down to help improve math and science education in high schools; and initiate an educational resource that involves international partners in co-creation and co-utilization.

So the first one, STEM Education – some people like to add the A for STEAM – and so these are the attributes of a STEM educated student. There are many others – problem-solvers, innovators, inventors. And the goal of BLOSSOMS are to enhance the development of critical thinking skills, engage students to think like a scientist in observation, experiment, and discussion, to connect abstract concepts to the real world, to show how exciting STEM can be, and to increase student interests in careers in STEM. And I think we believe very strongly that we all need to be STEM educated. It's not just for people getting PhDs. In order to make the decisions that citizens will have this century, they need to have this to be well educated in these areas.

So now I'm again going to show you a very short part of a video that is interesting. It's by a professor who combines mechanical engineering and biology, and we'll watch a little bit of this BLOSSOMS lesson.

> DAVID HU: Hi. My name is David Hu. I'm an assistant professor of mechanical engineering and biology at Georgia Institute of Technology. My lab is interested in how animals cope with their environments while they're moving, and today we'll be looking at how very small insects fly in the rain. Imagine that you've been shrunk down to the size of your pinkie nail. The world then becomes a very dangerous place. Raindrops, which originally were only a nuisance, have become the equivalent of five tons in weight, and they fall at a speed of 1,000 of your body lengths every second. That's incredibly heavy and fast.
>
> Although this scenario sounds like science fiction, this is in fact a daily reality for the world's smallest insects. Mosquitoes thrive in rainy and humid conditions, and they've been around for 200 million years and in that time have evolved a variety of mechanisms to deal with such conditions like wind gusts and the rain.
>
> By studying insects, we can gain insight into the simple question of how to fly in the great outdoors. It's a difficult problem. There are wind gusts, rain. And this is especially important for technology. Recently, there's been a lot of interest in what's called the design of microaerial vehicles, a very small flying –

Unfortunately, I don't have time to show you more, but you can tell that this is the exciting beginning. This is only a two-minute beginning and he pulls people in, and he's using physics, math. He's bringing it all in. We particularly like this because it cuts down the barriers between – he combines sciences and he combines math – because problems involve many different aspects.

And another thing we try to do is to introduce teachers in a gentle way to technology. And I think, very importantly, we made the decision to use video, and actually it turns out most people are more comfortable with video because it's something that they're used to in their lives. And also, we don't require that they have a broadband internet. We send our DVDs to people. We've sent them around the world if they request these in areas where they don't have good streaming video, and all that's required is a TV and a projector. Also I have to say here before I forget that a lot of teachers don't even use the TV and the projector. They just look at it themselves, use the materials, and give the lesson themselves having learned from the teachers.

The third point of BLOSSOMS was to encourage universities to reach down and help improve math and science. These are our partner universities so far. We've worked in all these different countries. And we wanted to initiate an educational resource that involves international partners in co-creation and co-utilization. I wanted to quickly show you another video that was made by a high school teacher in Jordan, and we voiced it over into English. And it's one of the most popular videos and it's used in the United States in the voice over version. And we think this is a wonderful example of co-creation and co-utilization. I'm only going to be able to show you a small clip –

> TRANSLATOR: Hello and welcome. I am Ghada Sulaiman Abdullah Marmash, a teacher in the school of King Abdullah the Second, His Excellency from Jordan. I hope that you can help me solve a problem. This problem will develop your skills in mathematics and require some knowledge of space and some knowledge of volumes. The juice seller faces this problem every day since he is always trying to pour liquid from two containers into a third one, and he needs to know this without wasting time or effort. Let's try to help him.
>
> Look. These are the containers holding the juice, and he wants to pour them into a third container. Unfortunately, he has no knowledge of the mathematics involved and tries to pour them into the third container. Let's see.

So again, I have to move on because I only have 20 minutes, but you can see that this was such a strong lesson that the teachers across the United States are using this and we hear about it all the time. We have 20 lessons from Saudi Arabia, and Faten will tell you about those also. So we really feel that it's so important to have co-creation and co utilization.

So for the students, it's critical thinking, but for teachers, it's equally important. It's to learn a new style of teaching. And we find that teachers are using these videos to model a new style of teaching, a more active learning for their students, not lecturing, because these are all broken down into short segments and also learning the kinds of activities that are challenging and that are problem-based, and collaborative.

The Hewlett Foundation funded us our first two years, and it was an international program. By the second two years of our funding – they stopped funding us for international, because they wanted us to do work in the United States. And that's why we've worked in Florida. We've worked in Washington, DC with schools there. We had our national contest that Sandra won. And just now, we're starting to work with Massachusetts teachers about how to prepare for some new standards that are coming down that are quite challenging for the teachers. And BLOSSOMS is working with Massachusetts teachers to make 10 lessons that will help to train Massachusetts teachers about how to use and teach with these new standards. And actually Massachusetts is number one in this country in terms of how well they do with education, but they know that their teachers need to learn how to teach with these new standards, and we're delighted to be part of that. And these are our distributors that distribute – and goodbye.

BLOSSOMS in Saudi Arabia

Faten Shaheed Ardekany
Project Manager, BLOSSOMS-Saudi Arabia

Chancellor, professors, Dr. Larson, Elizabeth, ladies and gentlemen, good afternoon. I'm very honored today to be standing amongst all of you to share our experience on producing BLOSSOMS. For the last couple of days, it was amazing to attend these sessions that are very informative, are very profound.

And it's time-consuming, and it takes a lot of time to unfold. While on the other hand, this experience of BLOSSOMS that I'm going to share with you, within 18 months from scratch, went from not having any idea about what BLOSSOMS is about to producing 20 videos and training 400 supervisors among the kingdom. So the message is it's wonderful to be part of a program that is doable, has an impact, and then you can see the difference.

To begin with, managing a project, I adhere to deadlines, and I bargain for time. I'm used to that, number one. Number two, I like everybody to be engaged. It is after lunch, and I'm warning you I'm used to working with educators who have a lot of load on their back. And yet they have to be actively engaged. So please be actively engaged. And to engage you, I have this question for you. It's a math question. Does the Braess Paradox mean anything to you? If it means anything to you, stand up and say, yes, in a loud voice. I'll give you a clue. OK. Anything? Any idea? All right. Those of you that it doesn't mean anything to them, still stand up and say, nay. What? I haven't heard you. Right. OK. Got the message.

Now if you want help about that, go to Saudi Arabia. Saudi Arabia can help you. Go to BLOSSOMS' site, and one of the lessons is called the “Selfish Driver and Traffic Planning.” So see what's the connection? Braess Paradox, Nash Theory of Equilibrium, pure math calculations, yet it was connected to traffic planning. This is what BLOSSOMS is all about. Today, this is our roadmap. We're going to look at Saudi in context of education, quick, quick, quick. Human capital is Saudi's real wealth. Transferable skills, the level of it in Saudi Arabia, the project, a tour, the impact, challenges, and lessons learned, and what is really the vision.

I want to tell you, everybody talks about Saudi, but in reality, Saudi Arabia is a very, very young country. In 1932, the country was founded. At that time, only children of wealthy people could afford to have a kind of literacy, so around 10%, even less, the literacy rate was. In 1938, oil was discovered. In 1951, there were 222 schools with 29,000, almost, students. In 1964, the first government school was established for girls. In 1999, there were girls schools throughout the kingdom. And in 2002, there where around eight universities, and in 2010, there was a total of 25 universities. Do you see? It starts really slow, and it's picking up, and it's making up strides. Now we have announced 5 million students, half of which are females, in all levels of education, higher education and in normal school. So the literacy rate now is even more than 83%.

Now when we talk about Saudi Arabia, we all think it's oil, it's money, it's dollars, it's wealth, right? Right. This is true. I'm not saying it's wrong. But the reality is Saudi's real wealth is its youth. Can anybody guess the percentage of young people, younger than the age of 24, how much is the percentage of the population? The population's around 27 - 28 million. Any number? I hear 30%, 60%, OK. Well, let's look here at the comparison. Now Saudi Arabia, 48.2% of the population is under the age of 24. If we compare this with the States, 33.7%. UK it is 30.1%, and Canada is 28.4%. So this is one fact that we really have to bear in our mind.

The other fact is education. There are lots of plans that are put on. But when it comes to transferable skills, there was a study that was made – it's a bit old, maybe 2008, 2009 – in the United Arab Emirates, it was called “The voice of the CEOs.” They really had interviewed CEOs on all levels, and they said, are you satisfied with the level of skills, the transferable skills, and the skills that an employee needs as critical thinking, problem solving, teamwork, creativity, innovation, et cetera? And in Saudi Arabia, 22% of the CEOs were happy with the level of skills. Now this is not too tragic. Because, remember, still there's a big population over there. That's our young. So these can be trained, and a lot could come out to them.

The government is really aware that it's a young population. There are so many skills that they have to learn. Because after all, what is the objective of education? It's to have the proper skills – the intellectual, the social, the psychological, to be able to function in whatever capacity that person is found. Because of this, the government was always very generous in really dedicating a big budget for education. In Saudi Arabia, the average is more or less about 19.3%. Now remember, the public expenditure is a big amount. So when we're talking about 19.5, it's around $58 billion dollars. It's a lot of money, and it is really distributed among schools, among universities, about sending people with their families to acquire the skills. So when we compare this to other countries, you can see that Saudi's public expenditure that is dedicated to education is really quite high.

Now with the awareness of the government that really we have to do something about education, we really have to take care of these children, there was a plan and there's an institution that was formed just to take care of education. It's called Tatweer for short. It's quite a long name. And Tatweer really had put a strategy that is long-term and medium-term that really had covered everything that anybody can think of. They had a pilot project, and there are so many lessons learned. So for those of you that think that Saudi is really moving very slow, it's not. It's doing a pilot project and collecting experience and information. Now they are ready to move to make strides. And they are making strides all the time. Between achieving that long-term vision and now, what is this solution? The solution is small initiatives that seem to be simple, but they are profound, and they have a great impact. One of these initiatives was the BLOSSOMS.

BLOSSOMS was an agreement that was sponsored by the Saudi Aramco. We would like to thank them very much. And MIT, again, their international contribution to betterment of the world is really highly appreciated. And they had contracted my organization, which is the Science Center – it's called Sultan Bin Abdulaziz Center for Science and Technology – to execute this project. The project entailed having 20 videos that were translated, subtitled into English in 18 months, and to train 400 math and science supervisors nationwide on the usage of BLOSSOMS and on the new pedagogy of BLOSSOMS. Again, to enhance critical and problem solving and just thinking skills. Now I would not dwell much on that, because of the time.

When we did these 20 videos, it's not easy. We had to have so many meetings. We have to have an outreach – universities, schools, institutions – to tell them what BLOSSOMS is. And it takes a while for people to know really. They think, oh, it's not a bad idea. I just have a lesson, I say something for two minutes, then I get an activity, then I go back. And this is how simple it is. It takes a long time to understand that the lesson is like a jigsaw puzzle. It's a big picture. And every segment, I unfold part of the picture. So not until the end of the lesson that the whole objective is achieved. There's this suspense, this interest, this passion that the students will develop. We want to finish this lesson to know, what do you want us to learn? So this was very interesting, for me, and for the whole team, that again I would like to thank.

When we had to decide, of course, with the MIT international team, we thought some of these lessons their theme should address some universal and regional problems. For example, there's a lesson called, “How Does Biotechnology Clean the Environment?” See, this is a problem everywhere. The connection between water desalination and making pickles. That, again, is fresh water. There's the problem of fresh water everywhere. The disease of our time, diabetes. Many parts of the world are suffering of this. The selfish drivers, which is the Braess Paradox and traffic planning, because Saudi really has a lot of traffic accidents. And in many parts of the world, people are acting in a selfish way while, in reality, they are delaying the whole process.

BLOSSOMS is about thinking globally and acting locally. Give it a flavor, a local flavor. And really people not only will watch, like the gentleman now asked, there's a lot that we can show off and tell people about our culture. At the end of the day, we all are one. We may look different. We may speak different. But in reality, we all are human beings. We have mind, heart, and spirit, right? So this is the message. But we have our own culture, and it's nice for people to be closer to us. So we have some of the lessons. They have culture relevance, for example, the geometry of parabolic sand dunes. Those countries that have sand dunes will love it. In Pakistan, the physics of donkey cart, amazing. You see what is the culture that is going on. We have a lesson called “Arabesque Groups – Where Are Meets Mathematics.” And I know Dr. Larson, he really was so passionate about this lesson.

BLOSSOMS is targeting high school age, 15 to 18. So we tried to find issues that interest that age group, for example, the physics of racing cars. See, Saudi Arabia, they have lots of cars, so it depends on every area. The magic picture, again, how would you hide it in a document? Then we have some general topics, like connections in the plane without crossing, why a bee hive has hexagonal shape, et cetera, et cetera.

Now let me show you, again, a quick tour for two minutes about the Saudi video. The impact of this after we spent 18 months, it's amazing. First of all, the process. All those stakeholders, be it videographers, teachers, professors, even at the organization that I work for, they start to look at science differently. They start to look at everything in terms of: “oh, we should make it interesting.” And what would it lead to? How can I connect it to their real lives? So science is not anymore in the lab and in silos. It became integrated in our life. These videos, they have thousands and hundreds of visits per month in Saudi Arabia, only these 20 videos. There are much more visits to the actual BLOSSOMS site, 200 visitors per month from the Middle East, and 90,000 people worldwide up to May that visited these 20 videos. As you noticed, there's the different flavor. And if you really watch these videos, you will notice that each one is different.

Now these videos, it had plenty of pain but plenty of gain. We had some challenges related to ideas. In the beginning, to break people's mindsets and the paradigm, to think out of the box wasn't easy, because they always thought of perfection. How can I be perfect? Well, perfection is a myth in reality. These videos, are they really perfect? Of course they're not perfect. Could they be better? Of course they could be better. But if we waited till we get the perfect idea, we wouldn't have done anything by now. So we learn by doing. We have a certain benchmark that we really try to achieve. But of course there's always room for improvement. So the idea was not easy. It took a lot of outreach until, when we met with 500 people in so many occasions, we got 50 ideas. And out of the 50 ideas, we had a special committee SME, Subject Matter Expert. We came up with 12 ideas. 12 ideas were sent to MIT, and we only got the first 5. The 20 videos, by the way, they were in four milestones. We did the first 5, knowledge was generated, and then we applied, and the subsequent ones were much faster. We had lesson developers.

You have to know that the target audience that we are working with are teachers, either university professors or school teachers. Their plates are full. They're there to teach. And then after their working hours, they have to think about all this. So really to motivate them and because, in the beginning, they feel very motivated, then they run out of steam, and you have to have a lot of passion and a lot of strategies. Thank god I'm a management trainer, so I had to walk the talk, right? And I had to test myself. We had managing expectations. Normally, sponsors, they want to have a show for their product quickly. And normally they'd say, well, is three months enough? It's what? Three months for 20 videos? This is not like a popcorn that we're going to put in a machine, right? So we had to manage their expectations. It was very challenging for the videographers,. Because, see, videographers are people who are used to production, to have scenarios, and to work on that. This is their expectation. While a BLOSSOMS videographer is a partner.

After a certain age, when the concept is really crystallized, they have to sit together and they come up with the ideas. We had logistics, lots of logistics, and every country has logistics. And then we had to do a lot of networking and building a relationship. My vision, in intake of this, is we really have to think globally and act locally. Well, there is one fact. We are all interconnected, and we are becoming interconnected by the day. We learn better when education is relevant. And to have education to be better, we have to think out of the box, and we have to look at our environment, at our culture. Once we do that, people's learning styles, everybody should have something to relate to. The bigger the pool of videos that we have, the more we will enable the high schoolers to enjoy and to be happy about this.

I want to tell you just one thing. These 1,100 visits per month is not very common. Because people, if they're not evaluated and there's no certificate, if there's no test, they will not go voluntary to a site and look at a video for fun. They look at YouTube. But this is the impact that we have created. People willingly, voluntarily, out of their own volition went and watched the video. Universities, they really have a duty in their communities. They have to serve their communities. Because it's a win-win situation. I contribute to the betterment and to the deeper understanding of high schoolers. High schoolers, when they join university, the bar will be much higher. So there could be community service, preparation schemes, and the resource sharing. This way, the education will be better. Now it's so important, this aspect of cultural understanding and awareness. So when we share ideas, we do share the culture, and we become closer and more understanding to each other.

And finally, this is how I see BLOSSOMS: it's a platform for sharing and for support. Believe me, if you come up with an idea, MIT, Dick, Liz, and the team are amazing. They just will walk you through, and you will not even feel it. So keep BLOSSOMS blossoming. And I have just a last request. We are here from 49 countries. These 49 countries, they have hundreds of universities, thousands of professors, thousands of individuals who will have the passion and the capacity to come up to make the world a smaller village. So please come on board, whether sponsors, whether lesson developers, because we become more connected to each other. Thank you.

UTM-MIT BLOSSOMS: Teacher’s Readiness in Developing BLOSSOMS for Classroom Learning in Malaysian Schools

Mohamed Noor Hasan
Deputy Director, Centre for Teaching and Learning
Universiti Teknologi Malaysia

Very good afternoon, everybody. I'm here to share our experience in managing the BLOSSOMS project Malaysia, as well as to talk about our teachers' readiness in developing BLOSSOMS for classroom learning in Malaysian schools.

Actually, our BLOSSOMS manager, Dr. Zaleha, was supposed to be here presenting this talk, as she prepared all the PowerPoints. Unfortunately, she was unable to come because of health reasons. Remember that it's a 20-hour flight from Malaysia to Boston, and she couldn't make it. I hope she's watching now, but it is 2 AM in Malaysia time, exactly 12 hours time difference. So you have to bear with me. I have to present the talk on her behalf.

OK. Let's start with the launching of UTM-MIT BLOSSOMS. In January of this year, we had a small ceremony. Dick was there. Liz Murray was there. We had a very ambitious plan to produce 20 videos in one year, which is quite ridiculous, actually. And according to date, if we produce 20 videos in one year, which the team from Saudi did in 18 months, then we break the world record.

But according to my boss, it's good to aim high, because if you can achieve half of them, it's good enough. So we did try to plan on how to get the 20 videos. Basically what we planned – to train teachers as well as professors in university, to double up the BLOSSOMS lessons. And if I can show you, this guy here is from the Ministry of Education. He's very much interested in the project. He supported us, and we probably will get some funding from them, as well. So that's why we have to train the teachers.

What I'm going to share with you today is some of the problems that we face with Malaysian teachers, and how we try to overcome those problem. The other activities that we planned include conducting research on BLOSSOMS. Because UTM is a research university, part of the BLOSSOMS project is funded by research grants. So we have to conduct some research to ensure that the money is well spent. So we have distributed some money for a few researchers to conduct research as well. I will give you the list of research that we have started on BLOSSOMS.

The first workshop took place in January right after the launching of BLOSSOMS. It was conducted by Professor Larson, Dan Frey, and Liz was there, as well. In the first workshop, we had 100 participants, mainly teachers – 68 teachers from all over the country and 32 lecturers from UTM Malaysia – were in the first workshop. Out of this, we planned that at least we can produce at least five videos from the first workshop. At the end of the workshop, we were quite lucky, because seven BLOSSOMS documents were produced. Five of them were approved by the UTM and MIT team, while the rest are still making improvements.

We have two lessons from the first workshop. One is to avoid grouping teachers from different regions, because later on, they have to work together to improve the content. So if the distance is a problem, then they won't be able to work together then. The second lesson that we learned is that it's good to form members with diverse backgrounds in one group. We had them sitting in one table, from eight to 10 people in one table. And they come from various backgrounds – math, physics, and chemistry teachers sitting at one table. This encouraged interesting outcomes from the discussion – lots of ideas and collaboration among different background of sciences and mathematics.

The second workshop was conducted in April of this year, and this time we decided to call only the university professors as our participants, and 20 of them turned up during the workshop. We invited also a professor from the English Department, because we might have problems with the language. We might do some scripting, and so on. We also invited people from the Multimedia Department. The group whose video had been selected in the first workshop were also invited to share their experience with the new participants.

In the third workshop, which was held in May, 2013, we called again on the teachers, some of them from the first workshop, especially from the Southern region, where our University is located. And we asked them to improve on what they have done. Some of them received very unfavorable comments from the MIT team. Some of them did cry because of the comments, like, " this is not deep enough," "the theory is wrong," or comments like that. And some of them blocked our phone number so that we cannot call them. By the way, this is Dr. Zaleha, our BLOSSOMS manager. She conducted that workshop very well.

We plan to hold the next workshop at the end of this month, and this time we will call teachers from other regions in Malaysia. I think about close to 40 of them have agreed to come. This is sponsored by the Ministry of Education because there are teachers coming. And for those who attended the first one, we told them to come with the previous document so that they can improve the document and hopefully it will be accepted by MIT next time. Well, really it was 30 who had registered for the third workshop. The reason why we did this workshop is because we think it's easier to call them together and then have them discuss the topic instead of having them working alone in their respective areas. So that's why we call them in a workshop like this.

Altogether, currently we have five videos in the process of shooting and editing. My staff in the Center for Teaching and Learning are currently quite busy editing some of the videos. After they are finished editing, they will summit the videos to MIT for comment and approval later on. And then if there's anything to be done with the video, they'll redo the editing and so on. So the quality of the video is guaranteed by MIT, actually.

I'm sure that by the end of this year, we can get at least 10 videos uploaded. All of the videos, all of the lessons currently being edited and the videos that are being edited right now are created by our professors. None of them are from teachers, unfortunately. So at this stage, we were discussing some of the challenges faced by the teachers-- why are they not forming, why are their videos being rejected, and so on. So we try to get a systematic approach to help the teachers so that they can design and develop a better lesson next time.

As you notice, there are two groups of video developers here in our project – one coming from teachers, from school, and the other group coming from universities. We have less problems managing the university professors, and yet we require more understanding on how to assist the school teachers in developing the video lessons.

What causes them to be not so creative? And we figured out that one of the reasons is because the Malaysian school system is basically exam-oriented. We have a national exam every year at the end of the year, and the teacher's duty is to ensure that as much as possible of their students get as many A's as possible in all subjects in the final exam. So it is very much exam-oriented. And they are bound by the curriculum, the syllabus. They don't have to go beyond the syllabus. So that's probably one of the major reasons why they are less creative in producing the video.

They also complained that they have hundreds of school activities to be done throughout the year. They have to take students to sports games, extracurricular activities, and so on. So they don't have the time to really sit down and think of very creative video lessons. Whereas the university professors, at the most only 40% depending on the exam below so they have to be flexible in the syllabus and so on. Therefore, the professors have more flexibility and more time to think about the video lesson, and also they are more creative in this case.

So how to assist the teachers to think out of the box? So these are some of the comments from the participants: “This is new to us,” “We require close guidance.” Those whose videos have been selected, they want to share their experience. They also want some reward system for them – at least a point in the KPI, and so on. So those are their comments – true comments from the teachers.

So let's take a look at the first sharing of experience and how we can guide these teachers. We think about this so-called COCIAL approach – cognitive plus social apprenticeship. The cognitive approach is more formal, and the social approach is less formal. We encourage the teachers to learn from the expert, and, at the same time, we encourage them to share with their peers, to share with their expert through social network – through Facebook, for example. So this is our approach, and my manager calls this COCIAL.

It can be divided into three stages. One is modeling by showing example. We have a website for the Malaysian BLOSSOMS projects. We encourage the teachers to look at some of the example videos from the MIT website. As I mentioned just now, we also have a Facebook group specially designed for the BLOSSOMS developers. Those who have attend the process, the workshop, are encouraged to be a member of this group. This is an example of our website, where we have links to modules. Catalog modules available. And we try to add each module that is available online – currently available at the MIT website – to the Malaysian syllabus so that the teachers know this video will be available for this syllabus example.

As an example, “Irrational Numbers,” one of the videos, is in the area of mathematics. It covers form one fractions, form one decimals, form 2-squared, squared root, and so on. So we try to map each video with the students' high school syllabus. That helps the teachers in selecting which video to be used in the class and which video to be used if they want to learn how to develop a good lesson. This is the Facebook group of UTM-MIT BLOSSOMS. Any announcements, any activities regarding the project will be disseminated through to this group.

The second stage of the COCIAL model is by coaching and scaffolding, supporting by the MKO. MKO is more knowledgeable. Others are more knowledgeable experts in the area, especially those whose video has been selected in the project. The teachers are encouraged to articulate, to develop, and to explain to others why they do this, why they do that, and so on. They are also encouraged to do reflection on what they've done, to explore and engage so that they become more independent in producing the content.

In that third stage of the COCIAL model, the articulation and reflection – those whose video was not selected by MIT were encouraged to upload their video on their local website. At least to make them happy. And also to give them the opportunity to reflect on what they've done wrong so that others can comment, so that others can contribute to improve their content. So they can upload their video to the Ministry of Education website or to our own UTM website so that other teachers, other developers can comment and they can also reflect on what they've done. So those are the three stages in the COCIAL model that we developed to help the teachers.

As a conclusion, as I said, the COCIAL model consists of three phases. It includes online as well as the face-to-face support from the expert. And we have agreed, more or less, to give a reward of about 500 Malaysian ringgit, which is less than 200 USD. A certificate and a point in the KPI if they can produce a video that is accepted by MIT. And I have a list of research projects which are currently being conducted in UTM. There are more to come, but for now, we have distributed the money to five projects, at least $30,000 each, to conduct research on BLOSSOMS – how BLOSSOMS can be used effectively to learn difficult topics, like thermodynamics, for example. What is the readiness of teachers in developing the video lesson?

So those are the research components of our BLOSSOMS initiative, which is a must for UTM because the money comes from our research grant. OK. So that's it for me, and thank you very much for your attention.

Special Program in Urban and Regional Studies

Bishwapriya Sanyal
Ford International Professor of Urban Development and Planning
Department of Urban Studies and Planning at MIT

Thank you. I want to first thank most of the class, and for inviting me. I'm sorry I missed first two days of the conference, because I've been traveling. I looked at the program, and I'm looking forward to reading some of the talks, and watching them, because there's a lot to learn from this.

I want to tell you why I agreed to participate in this conference on education. Because the work that Vijay mentioned on site, it's not directly on education, but you will see the implications for that project on education, which is a central activity of our development, and international development, which I work on. So before I describe the project site, I just want to tell you a little bit about how this project came about, and the history of ideas about projects, because the field of international development is not new. It started after the second World War, and it's almost 60 years of work that has gone into it.

And just very quickly, without going into too much detail, just let me sketch out some few points that might be of interest to you. When nations started developing – basically nations that have been colonized before – the goal was to turn these countries into industrialized countries. They were basically subsistence agriculture economies, and our goal was to industrialize – rapid industrialization and true urbanization. Urbanization was going to be one of the major mechanisms of that goal.

And so, that was the economic goal. Politically, many of these countries have come out of colonial rule. They were often tribal societies. And so creation of political democracies – Western style political democracies – was also a major part of the goal. And we thought we could do with this through implementations of large projects – infrastructure projects – because those are necessary for creating the industrial base of the country. People are going to be employed from the agricultural sector where they were in a subsistence economy. They would come to the city, work in large industrial production – the working class, formation of the working class. And then the country is going to be able to produce things, export things, get foreign exchange invested in large infrastructure again, and move on.

And education was a big part of it at that time, but, particularly not only primary education, but tertiary education like the ideas of which you, Vijay, mentioned. And I also went to school in India. It's a benefit of that kind of an approach. What is interesting for me in the development field is the turnaround that happened in the 1970s in reaction to this old model. And there was a lot of disillusionment with the old model. And the disillusionment came on two fronts.

Economically, many of these countries by 1970s where beginning to decline in standard GNP rate of growth, including Brazil, et cetera. And unemployment was on the rise. Underemployment was on the rise. People who were living in the cities and the periphery of cities, making a living in informal settlements and informal activities, with very low productivity – terrible way of life.

And politically, also by this time, many of these developing countries have turned into authoritative regimes. Latin America had all regimes except two that have become authoritarian. So people were beginning to question the paradigm of development that we had followed for the last 20, 30 years, and saying, what do we have to do differently? Who is to be blamed for this difference in outcome?

During this time – maybe some of you are born, others probably still not – there emerged a movement on "appropriate technology" by people like E.F. Shumacher. This appropriate technology school essentially argued that the problem of development was that it was too much top-driven. It was industrialization without thinking about people. So a lot of books started coming out, about development as if people mattered, et cetera.

And in general, large scale infrastructure projects, which were supposed to create employment, et cetera, they were discredited, and there was a huge amount of interest on taking the foreign aid and money straight to the poor, where the poor could do things on their own. They could build small things – houses, small businesses that they were doing before, but maybe do a little better. And to help them with this technology which they were using before to make it a little better, make it more productive, less expensive, maybe less dangerous.

So a huge amount of interest came to the term appropriate technology, which emerged at that time. In our story – of course, we are ahead of that in some ways now 20 or 30 years ahead of that time – around the 1980s, this appropriate technology and its emphasis on bottom-up development, low-scale development, small projects, livelihood projects – not large projects, not large technology, not big technology – this emphasis all of a sudden died. And it was very surprising, because things have not changed that much.

But all of a sudden in international development conversation, we are back to export. Export is the major reason for development. And because many of these countries by this time were in very serious debt crisis. And then when you are in debt crisis, you would need foreign exchange to pay.

So when you need foreign exchange, export becomes your central element of work. I'm talking about the early '80s, so all of a sudden, again we move to export, big firms. And a lot of people have argued this was the time of changing political climate to new liberalism, which essentially emphasized privatization, deregulation, and again, the third was export promotion.

So what we struggled with when we applied to USAID was a very interesting paradox. I had seen this in the field. I had been in the field for a long time. We noticed that even though this intermediate technology, et cetera, had gone down for a while in the 1980s, all of a sudden again in the 1990s, you see this emergence of large number of this small technologies in the market. The market is flooded with these technologies. And a lot of people, like Prahalad who came out with a book called The Bottom of the Pyramid, were saying that poorer people are willing to pay for these technologies if it helps them in their day-to-day lives.

Many governments realized that following this export promotion model had not really created much of a development below. It had generated some foreign exchange, but the country, which have so many poor people in such terrible conditions, that their lives hadn't changed that much at all, that something had to be done at that bottom level for employment creation. And generally, the conversation shifted from GNP, GDP, to quality of life. Quality of life, and essentially, what Amartya Sen, our colleague at Harvard, got the Noble Prize for: enhancing human capabilities. And how did that become the goal. And that's why I see education as directly a part of that stream of conversation of enhancing human capability as the central goal of development.

So when USAID just started, completely revamping their aid structure. By 2008 or 2009, they had this new fellow who is now the head of USAID who is a doctor. And they said, well, we need to rethink it completely, because all the aid we have given in the past hasn't really added up to much, and we need to rethink it. And this medical doctor, who wants to create, who wants to bring technology back in development, and again, particularly these kind of technologies for the poor.

So they asked for proposals. There were 500 proposals from 49 countries, and many, many of the American states, universities. And they gave seven grants, which is the Higher Education Solution Network of $140 million grant, of which MIT go two. And SITE the one Vijay mentioned is one. And the other one that my colleague Amy Smith is heading is called IDIN, International Development Initiative Network.

And I won't go into the details of the IDIN, but let me tell you what we are doing inside. Basically, when I wrote the proposal, I was taken by this paradox that the market had no shortage of technologies. It was flooded with technologies. And the question was development agencies did not know which technology to pick when they were going to fund projects, or when they were going to come help government.

When you asked them, how do these technologies work? They said, we don't know. There's a huge pressure for turnover. We need some kind of a framework to evaluate technologies. So we wrote a proposal saying, why don't you give us funding to MIT, because we have been in this for a long time, and we can come back to you with a methodology? And our methodology, which we are just starting, we have divided into three layers.

The first layer of the technology, we're calling it suitability of the technology. So let's say you have a water filter that you designed. And this is supposed to clear the water 40% or 70%. Does it do that? Or does it not do that? We are going to have lab tests, directly in the lab. Bring that thing back, tear it apart, take it apart, and look at it, how it is built, and the claims that it's making – is it true? And we're going to publish that evaluation like a consumer report, but for the poor. It will be used by development agencies around the world. So this will be comparative evaluation. We might take eight water filters, and rank them in different categories, or eight cooking stoves. I mean, you name it, the market is flooded, as I said.

The second level we are looking at is an issue that came up earlier on scalability. Many of these products actually do well – reasonably well – but then they don't get expanded. And nobody exactly knows why. If it's so useful for the poor, if it is reasonably priced, why aren't the poor buying it more? And so there are issues of markets, of supply chains that get disrupted in these countries. So we want to look at want it will take to scale these products.

And the third will be sustainability, which I know is kind of a buzz word. Now everybody has to use sustainability as a term to get any funding. But I think in our case, we used it by saying, we want to look at the impact of this technology, particularly in terms of its impact on the environment: where are the resources coming from, how it is being used, and what does it impact?

So we are doing this three-way evaluation. And we are working on this evaluation, which we are starting, we are working this evaluation process with our partner organizations in the field. For example, we have Partners in Health. As you know, Partners in Health is very known. One of their members became the head of the World Bank. Oxfam, UNICEF, Mercy Crops, and a few others – two or three other organizations, which we identified – because they have done this technology for at least last 15 years. They have tried this on the ground. And we want to work with them for them to give us, identify a set of technologies that has the most potential to make an impact, because they have worked on it. So we want to bring them here to MIT, work with them, bring the product here, offer courses, seminars, the consumer report, et cetera.

What I want to end with is to tell you that these organizations that we are working with is not a fixed list. We are looking for really interesting partners, people who are doing things on the ground. And I know many of the participants in the LINC Conference, you've done work there.

Now I realize your work is more focused on education, which I still think is a centerpiece of anything we do about how people use technologies. There's no way they can use technologies without really understanding what its use is for, and that requires some education. So if you have worked on the field, and you have worked with an organization that is grappling with this problem, please do contact us. I'll give you my card. I didn't bring my presentation, because actually I came back very late yesterday, and I was totally disorganized. But if you need to reach me, you have my email here at MIT. But I do again want to say that we are beginning the project, and we are looking forward to working with people who are struggling with these ideas on the ground.

And one last comment. A part of the project goal is to create two hubs around the world, other than MIT, which is the center of this particular work. We want to create hubs where this kind of work on evaluations of technologies will go on in the field, not in labs at MIT. We want to create these hubs either Africa – particularly in Africa, there's a huge amount of need – maybe Asia, where there's a bigger infrastructure. So again, if you know of institutions that might be interested in serving as a hub for us, which has some infrastructure, want to work with us, do let us know.

Last thing on IDIN, because Amy's not here. She's actually in the field. But IDIN, the International Development Network, actually has a very high overlap with Dick's work on the project of integration and in BLOSSOMS. How so?

Amy's argument is that around the world, if you look at the field, many, many poor people and organizations have created new technologies. They did not have the legitimacy like you have, with the technology comes out of the lab at MIT, with the stamp of MIT. But they have improvised things. They are doing things to make their lives better, either in food, basically in the housing, in health – many, many small things.

And her project valorizes that, works with those groups of people there. She has a big conference in August for a month in Africa where people come share their ideas. And essentially, she's trying to create a network – global network through which these ideas can be a more formalized, can be packaged better, maybe the costs can be lowered. And I think that, as these ideas emerge, we should be able to evaluate how they work. So that's the part of the project. Thank you.

“Other” EdTech “Stuff” at MIT

Brandon Muramatsu
MIT Office of Educational Innovation and Technology

I'm very fortunate, here at MIT, to be able to work on a wide, wide range of things. And I was thinking back with Bish, when you were talking, and we got to know each other as part of the Indian Institute for Human Settlements. It's interesting to me that, at MIT here, that mostly started my interaction with doing some international work. I've done many, many things internationally across my career. And being very, very involved in international projects has been very interesting to me, very fulfilling. And the interesting thing is, as Vijay Kumar was saying, I have a few different day jobs that I have to do every day, and so that's one of them.

My actual day job is to worry about what can we do with educational technology at MIT, working with MIT faculty, working with students, trying to improve the teaching and learning experience here at MIT. And what I thought I would do today is talk a little bit about some of those projects. Cecilia (Cec) d’Oliveira talked about some of the broad history that we have here at MIT of educational technology. I'm going to delve into some of the projects that happened more recently.

I think, Cec, it was very interesting, your talk about the excitement here at MIT. Here's a photo from MIT's 150th, a couple of years ago in 2011. At that time, we were celebrating the 150 years of MIT. That also happens to be the same year that we launched MITx, which would become edX, which would also become MITx again. You need a scorecard, even here at MIT, to keep track of this stuff. And so I thought I'd talk about some of the other stuff. And as an educational technologist, as a mechanical engineer, I get to use the word stuff in this way.

I'm going to talk about some modularity experiments that we've been doing over the last couple of years. So looking at our departments, and our courses, and how we might modularize and move from, say, full semester courses to smaller chunks of materials that you might be able take in many orders. Looking at some of our concept-based approaches. And then also, I'll talk very briefly of this notion of embedded assessments that we've been working on over the last couple of months.

Vijay, I don't know that we've actually explained what OEIT does? “ Stuff,” very good. OEIT works with MIT faculty and students in a number of ways. We partner with faculty. We work very, very closely with faculty. We like all of our projects to have a faculty sponsor, faculty member that we're working with. So to have direct impact here at MIT. We do lots of experiments. And I think that's one of the interesting things that we're doing is lots and lots of experiments. We're working with some faculty over the course of many years to transform some of the aspects of their teaching and learning, transform some of the aspects of their courses.

We also look at scaling up. Looking at what one faculty member might be doing and then looking at how do we expand that out to other departments, or the university as a whole, or going beyond the university. Much of my work before coming to MIT was more on the international and global scale looking at large scale open projects, large scale sharing of educational resources. And at MIT I get to focus back in on what happens in the classroom, like one of these.

And then also, we work with partners here at MIT to sustain these services. So it's great to do an educational innovation and to do something fun or cool in the classroom. We're trying to figure out, what do you do after that? How do you make it sustained? How do you go to that next level to move beyond an interesting idea or an interesting experiment into something that becomes a permanent part of the culture and the way of doing business?

Talking a little bit about the modularity experiments. Vijay mentioned very, very briefly this group called the MIT Council on Education Technology. It's a representative group across campus, members from the schools, the Dean of Undergraduate Education, the Dean of Graduate Education, Cec sits on it as Director of OpenCourseWare, Director of our libraries – very, very broad representation. Sponsored a set of experiments beginning in about 2011 to look at how we use modularity, splitting our large courses up, chunking them up into smaller pieces, and to do things about flexibility, and also maybe things about geography allowing our students to take courses in different ways.

So we got these projects started just as the movement was going. So it's an interesting set of things of what can we do here at MIT to improve teaching and learning with MIT courses. At the same time, we're doing all of these large scale things for the world. I'm going to focus mostly on one particular project. I2.002, it's mechanical engineering class. I was very fortunate to be able to use some of that mechanical engineering I learned many, many years ago. The department was very, very interested in this notion of looking at its curriculum, and how it was teaching its courses, and the interests of its students in being able to pursue what you might call a nontraditional mechanical engineering degree, giving them options on how they might go forward.

They suggested we work with this class Mechanics and Materials. It's a very, very traditional class or had been a traditional class until we got a hold of it. It's taught in rooms just like this with blackboards just like these, lots of them, lots of equations, lots of chalk. It's one of the interesting dichotomies I find here at MIT. We still do lots of chalkboard lecture. And we do some very, very interesting things with those chalkboard lectures. And it's an important part of the MIT experience. Problem sets, which are our homework assignments, labs. And you could call it MIT-hard. It really is a challenging class here for our students. So having mechanical engineering degrees, like a bachelor's and a master's, I'm amazed at the level of material we're presenting our students that they're working with, how it would come from many, many places across lots of different courses. They're all jumbled together into one. And it becomes a really interesting learning experience, I think, for our students.

We began these experiments in the spring of 2012. So the faculty members I've been working with, Professors Pedro Reis and Ken Cameron, came up with this model for the class thinking about it as a tree. It's a project we did in collaboration with the Teaching and Learning Laboratory here at MIT to do some of the evaluation work with it. It was funded by the MIT Council on Education Technology, the class of 1960, as well as the Office of Digital Learning.

And taking this tree metaphor, they thought about the class and how they might divide the class up. So there's a core portion, the trunk, that goes over 3D continuum mechanics. That's the thing that they feel that's the basis for the entire set of learning and concepts that are part of the class. But after that there are a number of branches. And so you can see up on the screen the different branches. And what they felt is that you could take these in any order. And this is the way we started off the set of experiments. Looking at, well, maybe we can have students take the very first portion. But if they need to go off to do sporting events, or to do a little short study abroad, or work on some other class projects, they can come back and take any of those other pieces in any order.

We actually didn't get to that part. Instead, we did some different things. We offered this course at a distance, which some of our colleagues in Course 6 have been doing for a while now. This is before we did 6.002x, edX, all of those MOOC-style classes. We've had some experience doing synchronous distance learning, but this was asynchronous distance learning with MIT students abroad in Spain, Puerto Rico, California, and there were a couple of students who were here in Cambridge who couldn't attend class. One of the things that we needed to do was give them a representation of the class. We weren't necessarily trying to kill ourselves – it was just to kill me – in making sure everything got produced on time. But what we did is we did lecture videos. So what we're doing right now, broadcasting the session out to everybody on the internet, recording it so you can watch it later, that's what we did. Not very exciting. Lots of folks do it.

The interesting twist though, and this is a 20-year-old twist for me, is we had a TA in the classroom. The TA's attended all of the classes. We had the TA write down the big concepts that were being talked about. So remember, this is on a blackboard. So it's not on slides. It's hard to link up to written text. But we'd have the TA write down, at 8:45 he talked about this and 9:10 he talked about this topic. And we'd have them go back and index the videos afterward. The real trick in all of this is it added about 10 minutes of work for every lecture. You didn't have to go back and really examine each lecture in great detail. You could just get close enough.

And so we used that as the basis for what we did this spring. So let's take this very traditional material that everyone's doing around the world, all of the colleges here in the United States, videotaping, broadcasting lectures. But let's see if we can do this little thing and improve the way you can find, and maybe learn, from the class. And it's a little too early to say – because I haven't gotten Glenda, who's sitting up in the audience, some of the data she needs to help us do the analysis on impact on student learning – but we took these lectures and we did this experiment.

This is a little website we built based off of that work. I'm going to do something crazy and do a live demo: " Welcome to 2.002. We're all very excited. First, a little brief introduction. I'm Professor…" So that was the first lecture, very traditional. You might go through and be able to watch that entire lecture. This class was an hour and 25 minute class. Lots of time, it's very difficult, very challenging to find materials within it.

So what we did is we took these notes that the TA had done of time points. We know which lecture it's in. We know which topics they're talking about. And then the concepts that were being talked about at the very specific points of time. We built this very simple browser. Actually, Cole Shaw built this for us, one of Dick's students, who's now coming to work with OEIT in a couple days now. And we built this little browser so I can click on 3D continuum mechanics, and I can click on one of the lectures talking about stress. And these are the topics that were covered in the class. And then I might look at toughness. It will seek to that point in the video and Professor Reis will go about and talk about what he did in class. So you can see exactly what he did in class. One of the things that we're very good at here at MIT, and there are a couple – Barry is up there somewhere, Barry is one of the videographers – there are very, very good video folks that work here at MIT. They are very good at capturing this style of material. It's traditional lecture, it's nothing spectacular from that regard, but we do a very good job of capturing it. Adding this little extra, you can now go back and search for it and find it.

This summer we have a project with a UROP student, an undergraduate researcher here, to take this, build it out to the next level. These are the topics and descriptions, over here on the right side of the screen, as the TA wrote them down. That's great if you're an expert in the area, you know words, the terminology you're going to use. We're going to have an undergrad who just finished taking the class go back and add some description and the ways the students might search for this. So it's taking a body of material and making it maybe a whole lot more useful. We have some statistics that we've been tracking, some analysis we've been tracking, to see how students have been using this. And we're going to see if we can correlate that to performance on the final as it turns out. We'll see how that goes.

One of the other experiments that I'll bring up. Cec was talking about a couple of the new classes coming out this fall on edX are Aero Astro classes. Dave Darmofal is one of the faculty members who's teaching one of them. We worked with him and a couple of his colleagues on 16.20 and 16.90. You should know by now that MIT loves numbers. I have no idea what those numbers mean, by the way. Other than it's Course 16, so its Aero Astro, and then some course. What they did as part of their experiment was to flip the classroom. So they had lots of materials that they had ahead of time – the lecture videos like we had before, or in the case of these faculty, course notes. And what they wanted to do is get some feedback back from their students before they got in the class. So very, very common sounding approach to flipped classroom. Look at the materials ahead of time. Maybe do some assessment. Try and get a sense of how you might do things in lecture, or when you get together as a recitation maybe, ahead of time.

One of the things they did is they had all of these web based lecture notes. What they did is they wrote a little set of scripts to embed questions directly in the content. And I think that's, for me, one of the big changes that we're seeing now with some of the pedagogy associated with the MOOCs is: content and assessment tied very, very closely together in a way you don't necessarily have to spend a whole lot of time or effort building into the system.

So from this idea, we expanded upon it. They did this in a way that would work for them in their classroom. What if we think a little bit more broadly and think about how you might take any assessment question and put it in any content? To start with, we're thinking about this in terms of formative assessments, so self-checks, helping the student understand what they're learning to do. It reduces lots of the complexity in security, authentication, authorization, all of those sorts of things that you really want to be certain of if you're doing this for a final grade. That the student *is* who the student claims he or she is, that they log in, and all of those sorts of things. As we've seen in edX courses, you get the content and the assessment quite closely together. So you get quick feedback loops, lots of opportunity to practice. We take this and do this with any content, anywhere. And this is a project that we actually were talking about a couple of years ago in 2011, and because Vijay has kept us way too busy, we've just gotten around to doing some work with that now.

We wanted to overcome some of the limitations of previous approaches. So this doesn't look amazing, does it? It's a simple multiple choice question. It's on a website. If I went to it live, I could, but then you'd get the URL and we're not quite ready for you to play with stuff yet. But I can embed this question. I can use iframe and put it wherever I want to. It's very standard technologies, JavaScript, CSS, HTML, embedding, very, very simple stuff. The idea is what's really powerful about this.

So I went to a Saylor.org course and looked for fractions. That happens to be what that example was about. And I found this YouTube video. I went in and said, look, so I've got this content anywhere on the web, but maybe I want to ask a question about it from my class. Can I embed that question somewhere? There's a different set of technologies that the folks that helped us develop this have built that I won't talk about today. I can talk about it afterward if you'd like. It's called the Open Tapestry that lets you do this across the web. In this case, I just went in and hacked this into the YouTube video. But imagine there's a video that you're watching that you've found as on OER somewhere on the web. And you want to ask these questions. You can embed this question anywhere. What's interesting, though, is I can then take that question and reuse it and use it other places.

So whether it be in my class or somebody else's class, I can take that question and start to use it. And we can start to build an interesting group of data about the use of those questions as related to content. It starts to push us down the realm of analytics and thinking about content and assessment a little differently than we have. So it's no longer a traditional, fixed course. It might be a piece of a course; it might not be something that I control directly; it might be something that somebody else has put up on the web – we start to get lots of interesting experiments.

I'll go to this slide, which is the "everything else" slide. As I was opening, I was talking about how I got to know Bish. And how one of the interesting memories I have, Bish, is of helping you with your BlackBerry in India. Yes, I do tech support on airplanes also. It costs a lot of money. With some of the things that we've been doing, we're doing a couple of initiatives, one in Haiti. So after the earthquake, MIT has mobilized a very, very strong response to working with Haitian universities and the Haitian government to take some of what we know and what we do differently here at MIT and work with Haitian universities to work through how that might work in Haiti. We've got a project. I've been down there twice for workshops. We have another workshop coming up. And so we're taking examples of how we teach at MIT using Mathlets, using some of the educational technologies, using our StarGenetics and StarBiochem, and things that we use with our undergraduate students here, that we use with high school students and middle school students here, helping the Haitian faculty see how they might be able to use these things in Haiti.

We've got another project, that is one of the other two things that is keeping me up at night, to do some work in Pakistan as part of a USAID project around online teacher education. Same sets of faculty members, Mathlets, BLOSSOMS, some of our science education stuff, and working to do online courses with some of those things. We do things around infrastructure development. So Cec has a slide about services. That's one of the things we think very, very deeply about in OEIT. What are services to enable things? So there's lots of things that you can do one-offs of, but being able to do this in a sustained way is one of the things that we think very deeply about.

The real thing that's keeping me up at night, and Vijay as well, is we're doing some work with community colleges. And trying to look at how do we blend some of the things that we're doing here with hands-on, and MOOCs and online courses with Workforce Development needs. And my time is officially out. So I will say thank you very much.

Technology-Enabled Learning: What's Going on at MIT?

Cecilia d'Oliveira
Executive Director of MIT OpenCourseWare

Thank you very much, Vijay, and welcome everybody, all you hardy souls who have come for the last session of this great conference. It's nice to see familiar faces here and also new faces. One of the things I'll say as a start is this is really an exciting time here at MIT. I think that shouldn't come as any surprise to all of you, given all of the discussions in the wider world about MOOCs, and edX, and MITx. But I'll say, in all the years that I've been here at MIT – and I've been here for 30 years, which my grey hair attests to – I have never seen a time when so many faculty were engaged in conversations about teaching.

I also have never seen a time when I've seen such extremes, in terms of people's feelings. Some people are very excited about what's going on and the pace at which it's happening, and other people are very uncomfortable. That goes for staff, it goes for faculty, I think a lot of people here. There's an expression, "the parents of comfort are sameness and familiarity." And we are not in a time of sameness and familiarity here at MIT. So the fact that we feel some discomfort, it's because we are on the cusp of a lot of good changes, and it's very exciting.

Now, Vijay started out his talk by mentioning the DNA of the environment here, in terms of ed tech innovation. And I certainly would not start my talk without acknowledging that as well. We have had an enormous two decades here at MIT in terms of ed tech innovation, and I'm going to start with just one very busy slide that gives you a sampling of some of the incredible projects that our faculty and students have been involved in, and we've been able to accomplish because of the generosity of corporate supporters and foundations and individual donors.

These go back, as you can see, to the early '90s, and there's a lot of things that are left off of here. I thought about putting BLOSSOMS on last night, and then I thought, no, I'll just say something about BLOSSOMS when I'm here. These projects, in many ways, are the foundations for what's going on now. MITx and edX are not being written on a blank slate. You take things like the xTutor, which came out of the Electrical Engineering Department here in the late '90s. A lot of what was in xTutor is the kind of online courses that we are now beginning to build.

Similarly, with the PIVoT project. Dick was the PI on the PIVoT project, which brought Walter Lewin to the screen. Many of the videos that were developed for PIVoT are being used in OpenCourseWare, and have become some of our most popular content. They're being re-purposed now, to some extent, in the MITx physics courses that are being built. So the bottom line is we're building on all of these things. We're not inventing from scratch, and that's the wonderful thing about MIT.

The other thing we're very fortunate to have is an incredibly strong infrastructure for digital learning already in place. This slide, which is a little bit much, I know, shows you organizationally the different groups, starting with the libraries, the Information Systems team, the Dean of Undergraduate Education, various departments, labs, and centers, and now this new Office of Digital Learning that are all involved, in one way or another, in either providing systems or providing services or support to the building and support of the digital learning environment.

The Office of Digital Learning is the newest one which was put together starting in December of last year. It brought together OCW, which until then had been a separate entity. Then we started building a new team MITx, which I'll talk about in a little bit about what they're doing. It brought together the Office of Educational Innovation Technology, which Vijay heads and which Brandon is a key part of, as well as our Media Production Services here at MIT. And this now has built a team of about 100 people that are really committed to the mission of bringing digital learning to this campus and also sharing the fruits of that with the outside world.

With that said, one of the questions that I get asked a lot now, both by faculty at MIT and also by people outside, is how does OCW relate to MITx? And how does MITx relate to edX? I think this is probably clear to people in this audience, because you're so knowledgeable about things that we're talking about now. OpenCourseWare is not online courses. That's first and foremost. OpenCourseWare is a publication. It is about sharing what MIT faculty have developed for use in their classrooms. We provide it under an open license. We want people to reuse the materials, redistribute the materials and, to that end, we distribute it through mirror sites.

I was here for Cliff's talk yesterday about the wider network, and WiderNet is a wonderful partner for OCW. We give them our content. We want it out and as widely-used as possible. There's a global movement behind OCW. A number of the speakers that I heard yesterday mentioned that they had OCW. Their universities were part of it. Korea has an entire country, Korea OCW. So that's OpenCourseWare.

Then we have MITx. MITx is about teaching. MITx is about courses, online courses. It is an interactive kind of experience. The goal is teaching and learning, not sharing materials. We have a new team that, as I said, we put in place to help support faculty in these developments. We use the term MITx in many ways. We use it to refer to the outside courses that we offer on the edX platform, the things known as MOOCs. We also use MITx to refer to internal things that we're doing for MIT students only. There are courses and modules that are being used this term in MIT classes that are running on the same platform, but an internally private one.

We also use the term MITx to refer to the team. And I see a number of members of our new MITx team here in the audience. This includes instructional design people, video specialists, project managers who are going to help faculty with these projects. MITx is also about research and experimentation. So these are very, very different things.

Now, Sanjay talked about what's the difference between edX and MITx. And I think this picture does a pretty good job of that, where edX is really the global theater for this stuff. It's a platform. Whereas MITx is really the production house, and it's the product. It's the courseware itself. Also, internally within MIT, there's a platform for a local audience, as I mentioned.

OCW's role in all of this is evolving, but I will start by saying MIT is still firmly committed to OCW's mission as it has been, that is open sharing. That continues. But we're also deeply engaged in helping launch the MITx efforts. A number of people on our staff are involved both in technology support as well as support to the faculty projects. OCW is also a source of material for some of the courses that we're building for the MITx initiative. And a number of the courses that have already gone up for a number of the MOOC courses are reusing older OCW videos, et cetera.

I think as we go forward, we're going to continue to publish MIT courses, whether they are very, very classroom-based, traditional courses or some of these online courses. One of the interesting challenges we have is if you have an online course, or a course that's largely online, what does it mean to publish that openly, like OCW does? What part of it do we actually provide?

Now I want to turn and tell you about some of the initiatives that we have underway. That's all kind of background. OCW after – how many years have we been at this now? Since 2002 to 2013 – 11 years – we now have over 2,100 MIT courses represented on our website. That's a lot of content.

In the early years, it was very basic materials, textual. In recent years, as we've done more and more video on campus, we've incorporated that along with rich kinds of media – visualization, simulations. Faculty often write textbooks, which they open source, and where we can, will provide those along with the OCW courses. One of the things that we're turning our attention to more and more is pedagogical materials, that is the voice of the faculty, in terms of how they teach the course in addition to the course materials themselves. I'll talk in a minute about one of our special initiatives along that line.

One of the things people say is, well, what impact have the MOOCs had on OCW usage? Here's the history of visits to the OCW website. This doesn't include use on mirror sites or other channels, but it gives you a sense of the kind of growth that we've had. And as you can see, between 2011 and 2012, we grew about 25% in terms of our usage. The MOOCs, if anything, have increased interest in the availability of OpenCourseWare materials. They're being used in very synergistic ways. There are some people that a MOOC isn't right for, and they continue to come to OCW. There are others who are enjoying the MOOC experience but use OCW as a supplement. So again, these are very synergistic kinds of offerings.

Over the years, we've enhanced OCW in different ways as different funders have come to us. Look, for the most part it's been funding-based. One of the projects that we initiated is something called OCW Scholar, which is a project we're in the third year of. We're developing a portfolio, a very small portfolio, about 15 engineering and science courses in particular, but there's also a microeconomics course in there. We've asked faculty to develop some additional content to round-out the offering so that it's much more complete for people who might not be able to access a library and get the textbook. We've also tried to include more tutorial materials, and we've reoriented the material into more of a sequenced, self-paced presentation. So those are our OCW Scholar courses, and we're finishing up that project this year.

Another project that we started back in 2007 was what we called Highlights for High School site. The goal of that wasn't to develop new materials for high school but to make the materials at MIT that are most appropriate for an advanced high school audience be more obvious and available to students. We set up this new part of our website called Highlights for High School. This past year we got some funding from the Dow Chemical company to add a substantial amount of new content to that site for chemistry. We worked very closely with the MIT Chemistry Department and the chemistry faculty, to pull a bunch of resources that already existed and put them online. And we also developed some new things. We have a reality TV series that shows MIT freshman going through the freshman chemistry lab course here, which is a lot of fun. The goal of that really is to inspire high school students to study chemistry.

The final initiative at OCW that I'm going to talk about is our Educator Project. I mentioned before that in the last few years we've been putting more attention to pulling pedagogical materials from faculty where they exist and trying to publish those. We've heard comments before from some of our faculty who say, you know, I love the way you've published my materials in OpenCourseWare, but, frankly, I don't think another educator could look at that and figure out how I really teach. And so we said, OK, well, work with us. Help us understand how to explain those kinds of things. And let's add those as supplements to the course publication. We're doing that now. It's in a pilot mode this year. We have the first of some of our offerings there. What we hope to do is make this more of a standard part of our course publication, so that when we put a course up along with it goes some commentary from our faculty about how they're teaching the course. Some of these will be very in-depth. Some of them will be more superficial.

Here's an example of one course where we've done this already. This is a nuclear systems design project course, which is a capstone course for students in nuclear engineering. In addition to providing the basic course materials, what we did is we went back to the faculty and interviewed him about a number of different things having to do with delivery of the course. And as you can see, some of the topics talked about were: How do you develop project assignments? How do you guide students through each phase of the course? How do you teach students to be engineers? And we provide access to this through, in some cases, video interviews, in other cases, simply just a transcript of the conversation. We're looking for feedback on this and we are going to be expanding this program as we go forward.

With the time I have left, I want to talk about some of the MITx initiatives, which, even though I'm the director of OpenCourseWare, I'm very involved in. MITx has both a residential MIT side to it and a global side to it, as I said before. On the residential side, our goal really is to work with faculty to reimagine how learning happens here at MIT. To that end, this year we set up a new system environment within MIT. It's basically edX software. It's the same tools, the same platform that's being used for the MOOCs, but it's a kind of MIT internal system. And that was used last fall by a couple of courses. This spring that expanded to about 10 courses, and there are about 1,200 MIT students who actually were using aspects of what was developed.

I just went through for each course and looked at the kind of things that they're doing, pretty basic stuff at this point. Faculty are using the MITx system to put up materials for students to read, to assign problems that students actually interact with and have to deal with before they go into class. In many cases, I think what you're seeing here is faculty looking at how they can flip the classroom from a lecture mode into one where they're doing different kinds of things with students, typically in small groups, when they come into the classroom. So that's the residential side. Very much a work in progress. And we look to expand that significantly in the coming year.

Now on the global side, I think seven MITx courses were delivered as MOOCs on edX this spring, with a total of about 300,000 learners, unique learners around the world. We've announced six additional courses, new courses that are going to be provided coming this fall, and they're a range of things. These aren't all introductory MIT engineering and science courses. For example, we're going to be offering an Introduction to Philosophy course. We're going to be offering a Global History of Architecture course. And we also have a couple of aerodynamic courses, which are fairly advanced. These are courses taken, I think, by MIT juniors. So the prerequisites for them are fairly significant in terms of mathematics. Some of these are going to appeal to smaller populations. They're not going to be the 50,000 people in a course. But we think MIT has a lot to offer, even for very advanced engineering kinds of topics. So we'll look forward to experimenting with that this fall.

I'm going to end now, before my beeper goes off, but I did want to tell you about one other project we're working on, which is very exciting, and I'm very involved in it. It's another MITx project. It's an edX/MITx collaboration, which we're doing with the city of Chicago. A program there called the Summer of Learning initiative, which is targeted at keeping high school students engaged in learning during the summer. And there are hundreds of organizations in Chicago that are part of this. What we're doing is offering a six-week online course for high school students that's based on the first four weeks of our computer science course that we have on MITx. And so we've kind of tailored it for a high school audience. That course launches next Tuesday, and we're real excited about it.

We don't expect to have thousands of students participating. Because, again, this is MIT-level material. And so we're looking for students, most of whom are going to be in the science tech high schools in Chicago. We are welcoming other people from around the world, but our primary focus is on that audience. So that's going to be a very interesting experiment. As I said, it launches next Tuesday, and we're looking forward to that. So thank you.

Technology-Enabled Learning at MIT: The Students' Perspective

Cody Coleman
Electrical Engineering and Computer Science, '13

Good morning everyone. Thank you for having me here for the LINC Conference. It's a pleasure to speak. I'm Cody Coleman, a graduate student in the Electrical Engineering and Computer Science Department. I'm currently pursuing a master's degree, a Masters of Engineering.

Today, I want to tell you about two turning points in my journey through academia. The first, to set the stage, is about where my passion and motivation for education comes from, which I hope will shed some light on what's really at stake when we talk about education. Despite the countless, sleepless hours I've spent in lab or studying for an exam, I realize that a lot of what determines success in education has nothing to do with the classroom at all. Then, with that in mind, you'll be able to better understand my work so far as well as my vision for the future of education. I'll secondly dive into my work at MITx.

So simply put, education saved my life. I started out at the bottom of society, but through hard work and determination, I was able to make it to the top. When I was born, my mom was in prison. My father left before I was born and to this day probably doesn't even know if I exist. With both my parents incapable of fulfilling their job as the guardians for me and my siblings, my grandparents thankfully stepped in and tried to adopt all of us.

However, despite their kindness, life wasn't easy. My grandparents were very old and they didn't know how to guide us, nor had the energy to. Eventually my mom came back into the picture, but she was filled with bitterness from her experiences and didn't really care about our well-being. To make matters worse, we were poor. The only sources of income that we had were the money that my mom got from governmental assistance and the social security checks that my grandmother got, which was just enough to cover the taxes on our house. So we struggled. We struggled to get food on the table, clothes on our back, and a roof over our head. It didn't seem like any of us were on the track to success.

Fortunately, education opened my eyes and made me realize that the life that I dreamed of could actually become a reality. Of course, this didn't happen overnight. This enlightenment didn't happen overnight. At first when I went to school, there was only two reasons why I went to school. First, it was an escape for me from all the issues that I faced at home. It was a way for me to get away, and instead of being bombarded by fights and all the issues that we had, I was bombarded by knowledge. Secondly, it was a free meal, and even though it wasn't great, bad food is better than no food at all.

Moreover, I didn't really excel in school. I actually started out in remedial English classes and my math scores were actually average at best. The school that I went to was a poor performing public high school in New Jersey. We were 79 points below the state average on the SAT for the math section, 62 points below the state average on the verbal, and 71 points below the state average on the essay. The ratio of students to computers was 19-to-1, over 6 times the state average, which makes it very tough for an aspiring computer scientist.

However, none of that really mattered to me, because I had an indomitable motivation. I didn't want to live the life of hardship that my family did. This drive was my first turning point. This drive manifested itself in two characteristics, endless positivity and naive optimism. I turned the negative things that were going on around me into fuel for my journey, and I never counted myself out. I went after every opportunity regardless of how small of a chance I had and, so far, it seems like that's worked out. I'm here today as a recent graduate from MIT that graduated at the top of his class with a 4.9 GPA.

I've worked at Google for the past two summers, and I've been able to travel the world to China, Mexico, England, Switzerland, and soon India through numerous programs here at MIT. Yet my story doesn't end here. This is only the beginning. It is my turn to give back. Education, as I said, saved my life. It's akin to an accelerator, which instead of helping start-ups to grow opened up my life to a world of possibilities. Now I want to take that one step further, and I want to open up that same transformational process to as many people as possible. MITx is the perfect place for me to do that. It combines my love for computer science in such a way that I can benefit education.

So this brings me to my second turning point. Being able to work here at MITx has been kind of a gift. It's been the perfect combination, the perfect job, for me to achieve my ultimate goals. So for my master's, my main project is about rethinking the way that we interact with video. We're analyzing video in order to pull out insights for instructors to give them insights as far as how to make their lectures better, as well as developing novel ways of interacting with video in order to increase user engagement. My work so far has been focused on the latter part of that, but as I progress, I hope to get more involved in the analysis of video data.

Currently, I have been developing video clipping tools for the edX platform which will allow students to embed video clips directly into open-ended responses. This is done through a simple interface where a modal window pops up allowing students to jump to the specific segment in the video and capture the start and end times of that video. Then when they're completed with that, it embeds a thumbnail into the question, which is then seamlessly passed through the system for staff, peer, and self-grading.

Now, this project is a humble beginning of many more advancements in education tools and research. This tool that I've developed has sparked interest from Stanford, Harvard, and MIT to create an integrated annotation system in the edX platform for text, image and video annotations. This system will not only set the groundwork for many new problem types and assessments, but it will also give students their own digital notebook.

Student annotations on a course could be aggregated together to serve as personalized study material or a long-lasting reference to refer to for the rest of the student's life. From a research perspective, these annotations essentially are open sourcing the process of identifying highlights in a course to the students. These highlights identify key takeaways for the course, or best practices in increasing user engagement, as well as serve as an overview for the course to potential students. All of which both from a student and educator's perspective, are priceless insights.

To end, I want to tie everything together with a word of warning. As educators and people passionate about education, we all appreciate and understand the value of good teaching and the impact that education can have on one's life. I'm sure there are plenty of people in this audience that have also had similar life-changing experiences to that of my own. However, it's key to remember that these recent improvements in technology and teaching, such as my video clipping tool, are only part of the battle in education. In order to advance education, we need to M. I. T. – to motivate, to inspire, and to teach. Because even if we build the best tools to learn and teach, it doesn't matter if we don't make people want to learn. People can and have learned a great deal without technology, but undoubtedly technology does make it easier to learn. But if we don't stimulate interest and inspire people to continue when the work gets hard, it doesn't matter how easy we make it to access the material or how seamless the technology is integrated into education.

When I think back on my fellow students in high school and what separated me – why I was the one to go to MIT, why I was the first one from my high school to be here and to graduate from this institution – I realized it wasn't money. I didn't have any of it. My family didn't have any of it. It wasn't inherent skill. I started out at the very bottom. I wasn't smart. I'm still not smart, I just work hard. It wasn't access to technology. We didn't have internet at my house. We didn't have a computer. I didn't have a cell phone. I didn't have any of these fancy gadgets that people grow up with today. I actually had to go to the library in order to use the computer or take one of the few computer science classes that we had at my university in order to get access to things, and even then, we had firewalls blocking you from half of the sites out on the web.

Really what separated me and what made the difference for me and enabled me to achieve what I have so far is the fact that I have this drive, this motivation. What I want to do is to inspire others and to give other students that motivation, because that's half of the battle. If we don't get people to want to learn, it doesn't matter how great our tools are. So in short, I want everyone to walk away today motivated by the technologies we've all seen, inspired by the shared successes we've had, and ready to teach others about the importance of education and what we need in order to make the world take advantage. Thank you.

Inspired Education – A Student's Vision

Sam Shames
Materials Science and Engineering, '14

First off, I just want to thank Professor Larson and everyone here at LINC for inviting me to talk to you guys today about a topic that I'm really excited by. My name is Sam Shames, and I'm a rising senior studying material science and engineering.

We've all heard a lot over the past few days about using online education to better engage students and to produce active learners with 21st century skills. I want to talk with you all today about how I became that type of student through project-based learning, and about how online education creates an opportunity to extend this type of learning to all levels of residential education. The title of my talk is, "Inspired Education – A Student's Vision."

I grew up in Newton, Massachusetts, which is 20 minutes from MIT and went to Newton North High School, a regular public school. I had a number of wonderful teachers during my four years there, but the one that inspired me the most was Steve Chinosi. Among other things, Mr. Chinosi taught a class called Senior Year Project. SYP was a project-based research seminar where students withdrew from their regular classes in order to pursue an independent semester-long research project on a topic of their choice. Senior Year Project was the first class that inspired me, and it changed the way I thought about education.

During the first part of Senior Year Project, my classmates and I learned advanced research methods. We learned strategies for finding relevant information from primary and secondary sources, how to write a literature review, how to prepare for and execute an interview, and how to communicate our findings effectively. At the same time, we were also preparing for our independent inquiries and getting comfortable with the expectation that we would take ownership over our education and learn independently.

For my Senior Year Project, I proposed to study the efficiency of a type of biodiesel processor called an Appleseed. Although I knew very little about biodiesel and had never done any sort of project like this before, I was excited by the idea to learn something new and also by sustainable energy. Because I had never learned independently before, I had moderate expectations for my project, but I quickly discovered how much I enjoyed the freedom to learn about a topic that excited me in any way I chose.

Driven by my enthusiasm, I not only researched the efficiency of different type of Appleseed processors, but I also designed and built my own Appleseed using a $500 grant which I won from the Newton Conservators. I wrote a 25-page research paper about my project, presented my work both informally to an audience of my peers and before a formal committee, and I maintained an online Wiki where anyone could see my progress and learn about all the work I'd done. I blew my expectations out of the water and walked away with a newfound appreciation and enthusiasm for learning.

Through Senior Year Project, I learned to set goals and to work independently to complete them. I developed grit as I struggled to complete my project and build my machine. I remember exactly how excited I was the first time I turned on my finished machine, and then how frustrated I was when I saw it leak immediately afterwards. But despite all the obstacles I encountered, I refused to give up because I cared deeply about what I was doing. It was a level of perseverance I had never experienced with a traditional assignment.

Most importantly, Senior Year Project gave me the feeling that I could learn anything. After all, I told myself after my project is finished, if I can become an expert at biodiesel, there's no reason I can't take the same series of steps to become an expert at anything, be it programming, architecture, or engineering. I developed a sense of self-efficacy and gained a confidence that has helped me excel here at MIT.

Equally as important is that my experience with Senior Year Project was in no way unique. In Senior Year Project, I watched students become passionate learners who had basically slept through four years of high school and who had never engaged in a traditional classroom. Senior Year Project turned my classmates and I into inspired students by asking us to challenge ourselves far beyond what we ever did in a normal classroom.

Unfortunately, though, most students never get this opportunity and never get the feeling of inspiration that transformed my classmates and I. I imagine a world where the classroom is a place of wonder and joy, where all students are transformed by what they see and given the freedom to discover just what is possible. I imagine an education system centered on classes like Senior Year Project, where students work on problems they care about and the learning process transforms them into passionate problem solvers.

This transformation is being made possible for the first time because of new technologies that are being developed for online education and digital learning. Technology-enabled education will help students discover a potential that too few reach in today's classrooms. The real power of online education comes from changing the role of the teacher and empowering the student.

Through resources like MITx, Khan Academy, and even Wikipedia, students today have access to concepts and equations that were once exclusive to teachers and textbooks. This means that teachers no longer need to spend class time lecturing, and can instead focus more on the magic of the interpersonal, where we know so much of the learning happens. I imagine using MITx to develop something like a digital concept library where, instead of presenting material in a rigid structure set by a teacher as in a traditional class, or even a MOOC, all material and concepts are always available, ready for students to mine for the specific project or application. This platform enables active learning because it gives students responsibility for finding and sorting the relevant material, and also allows them to design their own learning pathways.

The digital concept library has different levels of structure and can be thought of as a multiverse. At the highest level are the universes, subjects like physics and biology, but also interdisciplinary areas like energy and robotics. Inside every universe are the different galaxies, representing sub-disciplines like molecular biology, statistical mechanics, or microeconomics. Inside these galaxies are solar systems, each of which contains a different topic related to a sub-discipline like DNA replication, entropy, or the chain rule. At the lowest level, within each solar system are the planets, and each planet represents a different way of learning a key idea. The planets could be videos, lecture notes, books, interactive demonstrations. The goal is to have as many different types of content as possible reflecting the diverse learning styles and individualized needs of every student.

The digital concept library offers a whole set of learning pathways and gives the individual the opportunity to choose the best one for his or her needs. In many cases, the learning pathway is determined by the application or project a student is studying, but larger, more complex problems may offer multiple learning pathways. The virtual library could use arrows to represent connections between the different planets, solar systems, galaxies, or universes. This format highlights the relationships between different topics and helps students design efficient learning pathways for their project.

This virtual library is only one possible model for organizing online content in such a way that it's accessible to all students. Any model that offers a centralized source where students can find and sort all the information they have traditionally gotten from teachers and textbooks will work. Such a platform will enable widespread adoption of project-based learning, ensuring that students spend less time figuring out where to find information and more time interpreting and applying it for their needs. The platform gives students a chance to take control over their education and puts them on a road that can take them anywhere they want to go.

Another way online education enables project-based learning is through innovations in assessment. In Senior Year Project, every student had to maintain an online project portfolio, which anyone could look at and see both what the student had learned and on what stage of the project they were. The benefits of the e-portfolios, for student-driven demonstrations of learning, as I sometimes like to call them, is that they give students an active role in showcasing what they've learned, giving them the freedom to demonstrate their learning in a way that is meaningful to them and fits into the context of their project and learning goals.

Online education makes project-based learning possible at all levels of education in almost every subject. I've experienced firsthand how this model of education empowers and inspires students. The challenges to widespread adoption are both technological – the creation of something like the digital concept library – and developing new pedagogies. Education is among the most powerful forces in the world, and I doubt there is a better social equalizer. The opportunity is to utilize new technologies and digital learning to reinvent residential education, equipping students with the 21st century skills to solve the world's toughest problems and inspiring them to become lifelong learners. Thank you.

Technology-Enabled Learning at MIT: The Students' Perspective

Ethan Solomon
McGovern Institute for Brain Research, '12

What I want to talk about, I guess, is a little more down to earth. When I was working for *The Tech* and paying attention to all the stuff that was coming up with MOOC in late 2011 and early 2012, something I was struck by was how much enthusiasm there was for the MOOCs. But the people who had this enthusiasm didn't even seem to have ever tried the MOOC themselves. And I was really struck by that.

I'll be honest, I read Thomas Friedman's several columns in *The New York Times*, and he really gushed about these things, but never did he mention any of his personal experience with it. And I doubt Thomas Friedman sat down and actually took any of the MOOCs that he said were so amazing. And it's the MIT way to be skeptical, and it's the MIT way to see things for yourself and to evaluate them for yourself, and not just take it on the word of whoever is building the MOOCs that they're really, really great.

So that's what I wanted to do. I said, now that I'm graduating I'm not taking classes at MIT anymore, maybe I can start taking classes online. And that's a lot of what I've done in my free time since graduating last year. My friends think I'm totally nuts, but instead of watching TV, I get to watch lectures now. But it's actually a lot of fun. And what I want to talk about is what I thought was really good about some of these online courses that I took on edX and Coursera. And I've listed the ones that I've actually taken through and through. And things that I thought weren't so good and where there's room for improvement.

So first I'll start off with the positive. What did MOOCs do well? And I think they did a lot of things very well, but there are a couple of key innovations that I think are really important and which distinguish MOOCs from the courses that you might take at MIT or any of these really top-tier universities that tend to be publishing MOOCs right now. The thing I actually really like most about taking online courses is this try, try again philosophy. And it's been alluded to by, I think, a couple people here, and I'm sure you've probably heard about it in your few days here, or if you've been following MOOCs yourself. When you're taking a class on campus, you do a problem set and you write down the answer and then you hand it in and that's your only shot. As it turns out in MOOCs – well, oftentimes in MOOCs – you actually get several tries, if not hundreds of tries.

In this case, this was from a course on MITx 600x, computer science and programming. You have 30 tries to get the answer correct. You code up something which is some function which is supposed to do something, and then you submit it to an auto-grader and it checks through it. But if you get it wrong, you've got 30 chances to get it right. Which is really great because, basically, you think, well, I can almost never get anything wrong. With 30 chances I could almost use brute force and I could just take 30 guesses and the chances are I'll get it right.

And that's sort of true, but if you actually try to approach it from a more intellectual standpoint and you say, I'm not just going to brute force it, it's really great because you actually get to sort of work through in your head what didn't work, what does work, until you finally come up with the right answer, rather than just submitting a wrong answer and getting some feedback from a TA that your answer is wrong. So I thought that was really great. I put this first because I think it's one of the best innovations from MOOCs. I think it enhances the learning and I'm sure there's research into how this happens.

Going along with this, something else I found is that these little green checkmarks you get when something is correct are super addicting. There's no actual reward from it. I'm not getting paid, I'm not even getting credit for this stuff, right? It's just online. And yet, when you have all these 30 chances and you know there's a correct answer and you get it wrong, you don't just say “oh well”, you can't leave. You're like, I'm not going to go and get lunch until I get this right. And then you'll sit there for two more hours and you'll keep on doing it until you get it right.

Again, it's sort of counter intuitive because I didn't expect that going in. I thought, well, I'm not being incentivized by any credit hours here or by any money, I'm just sort of doing this for my edification. And yet, those little green checkmarks are super addicting. I have to try and try and try again until you see the little green checkmark. And this is something else that you really can't get in the on campus experience where you write down an answer on your problem set, and you're not given feedback on whether you're right or wrong until like a week later when the TA has graded it. So, in on campus experience, I don't think this effect even exists.

This, I think, has been alluded to a lot. This concept for people you have probably heard talking over the past few days, but MOOCs are essentially streamlined. I find them to be more efficient information delivery systems then your traditional brick and mortar on campus classes. And that's in the sense that MOOCs cut out all this kind of “administrivia” that you need to deal with when you're in a normal campus course. You come into class, you've got to wait for everyone else to sit down, the teacher has to go over when the problem set is due, things like that. You add all that up, that's at least five to 10 minutes from each lecture, over several dozen lectures over the course of a semester, that's several hours, probably, of your time sitting around listening to stuff which is not learning, and which could be much better conveyed through a static website that tells you all the due dates.

This is a screen shot from a Coursera course – and you're familiar with this concept – where a normal lecture has been broken up into these chunks of shorter lecture segments. And all the fluff that's maybe in between them has just been sliced out. So it's more streamlined, it's more efficient and it's great because you're learning, I think, the same amount, or roughly the same amount, in the same order of magnitude, except now in less time. And to go along with that I'll say, MOOCs, somewhat, let you learn at your own pace. And I know this has been a big, well-advertised aspect of MOOCs. That the learner can find his or her own pace when it comes to learning, rather than being stuck to the pace of the on campus course. And that's not fully true in MOOCs because there's still deadlines for assignments, and lectures are still published at some regular schedule. And they usually do more or less follow how it would have been on campus, but there are a couple of tweaks. The one I liked being that you can watch lecture videos faster than real time. I don't prefer 1.5, that's way too fast, but 1.25 is a nice pace. But if you want to make it go slower you can too. And this technology is pretty good. It'll try to match the speakers tone no matter what level you're playing it, so it always sounds somewhat natural. At 1.5 it does sound a little funky sometimes, I will say that. You should try it.

So those are the innovations that I liked best. But, I think, for everything that I really liked, there was something which I thought could be a lot better. I'm going to preface this by saying the reason why I'm talking about all this is not because I think MOOCs are bad or I think MIT is doing the wrong thing by putting out MOOCs. It's actually the contrary. It's that I want MIT to succeed because I think this stuff is important and this stuff can be meaningful, as everyone has said. But, unfortunately, I don't think Thomas Friedman's method is the best way to do that. Just telling everyone that they're all awesome and not telling them how can you better is not constructive. It's not the MIT way. So that's just the preface here. I don't think MOOCs are bad, I just think that there's ways that could be better.

And the one thing, which is probably really at the top of the list is feedback. And everyone uses this word feedback, but I don't think it's often well defined. Feedback can come in different forms. And in the form it comes in MOOCs, I think, is the barest minimum form of something you can even justifiably call feedback. And that is, to an order of magnitude, the feedback is right or wrong. You did your question, you submitted the code, an auto-grader runs the code, it checks your answers against a couple test cases and it says you're correct or you're not correct. In an on campus course you could have written some horrendous code that gets the job done, but you did it in twice as many lines as you needed and it's a very clumsy or it doesn't use an elegant algorithm, and you'd still get it right. And as far as the MOOC grader is concerned, oh, yeah, you got it right.

This is a screen shot from a machine learning class from Stanford on Coursera. Feedback, nice work. Well, what could I have done better? Was my code inefficient? It didn't really measure how long it takes. Now, to be fair, I think this is one thing which everyone who's developing MOOCs is really thinking a lot about. So I point this out because this is where MOOCs, as far as I've seen, and the form MOOCs have taken, this is where they are now.

No one thinks that this is an acceptable status quo. Obviously, you want to be able to give people higher level feedback on all sorts of things.

And then when it comes to humanity in MOOCs, this is even more important, right? Because people are writing essays and people are doing short answers, and there's no objective right or wrong in that. You need to be able to give nuanced feedback. How you give that feedback is still an open question, but for everyone who takes a MOOC, I think this is the thing that you'll find to be most different and most unsatisfying relative to what you've probably taken in a college course. You want to know *more* about why you got something wrong, how you could have done it better, and even if you got it right, how was it not totally 100% optimal?

I think this has been mentioned by a couple of speakers already, too, and that's the lectures in MOOCs are sort of the same thing as what you'd find on campus, even though the space of possibilities is so much greater. No one's seemed to step into that space in a really robust way. At least not as far as I've seen. And what I mean by that is that lectures are basically the same thing that you'd get sitting here in 10-250. There's a professor, there's some PowerPoint slides, they're scribbling on the slides. They could have done that on campus. What they couldn't have done in on campus setting is do lots of interesting, or even interactive, some kind of animation. They could have brought you to another place in the world and filmed something interesting happening over there. Right?

Again, this is not something which people are unaware of, but it's something which I found to be unsatisfying. Take advantage of the fact that you're not constrained by the physical world anymore, right? Do interesting things with the lectures. And along that same line – something like what Cody mentioned – is sort of integrating more interactive aspects with lectures, note-taking annotations would be really nice.

Course organization, I want to mention this. This is not one of the bigger points, but something I discovered in 600x where the course team, for a while, seemed to actually struggle with meeting their own deadlines for when they said they would release lectures or problem sets. MOOCs are obviously works in progress, but when you're trying to scale these types of things to tens or hundreds of thousands of people, it can be challenging. And that's something which was, I guess, unsatisfying for me and some people who also took it – 600x – that there were some, at points, significant organizational problems. I can tell you more about those in detail. This is just a screen shot of the little progress indicator in edX. And I didn't really take much of the final, actually, because I was busy. But this is sort of just organization regarding when you publish all those kind of things, right? Lots of p-sets, you have to make sure they're all published at the right time, the graders are up at the right time. It's a challenge.

One last point I want to make, which is a little tangential, but it's sort of more informed by my experience working for *The Tech* than just being a student at MIT, and is something I've noticed about the whole MOOC phenomenon at MIT. The enthusiasm for the technology does not quite seem to be matched by an equal enthusiasm for improving the campus and having the campus meet the needs of 21st century learning environment. And what I mean by that is here I'm showing you – this is the campus visioning exercise. They don't call it a plan. It's called MIT 2030 and it's supposed to be a framework for what MIT is supposed to look like in 2030. So, in 20 years from now. And the colors basically represent various types of new construction or renovation on campus. And something I'm struck by when it comes to the whole visioning framework as it stands right now, is that there's not a lot of people talking about how the campus could change to meet the needs of 21st century learning environment.

Like Sam described, if you're going to move to a model where you're doing more flipped classrooms, where people don't need to sit in these giant lecture halls anymore, where people need to do more project-based learning, where people need the resources to do that project-based learning, and where you need more faculty to do the type of instruction that Sam is talking about, the infrastructure right now doesn't meet it. This room is useless. Right? What is this room for in an age where you don't go to lectures anymore? It's totally useless. Well, except for conferences, maybe, like this. You don't need so many of them. We've got many of these lecture halls on campus. And a lot of what's described in this visioning exercise right now does not really talk about how you're going to change the campus environment to foster the type of outside learning and the project-based work that you're going to do when edX and MITx are more fully deployed. Most of this, actually, and what all the emphasis has been on – a lot of the emphasis has been on since 2030 was announced – has relied on commercial development on the campus periphery. And for a student, that's very unsatisfying to see.

Because commercial development for Novartis and Pfizer, sure, they need great new campuses, but so do the students here at MIT. And I guess I haven't seen the emphasis on that yet, but also, to be fair, there's a whole committee and task force at MIT here thinking about this and working on this, so I imagine it's quite possible that this 2030 vision will be updated. This is not set in stone, by any means, it's to sort of more meet the needs of a 21st century learning environment as I describe it. So that's basically it. Yeah.

The MIT LINC 2013 Conference

Parallel Presentations

Session #1	The Internet and Education: Case Studies from around the World, Part 1
Session #2	Innovative Online Learning Environments
Session #3	The Worldwide Development of MOOCs
Session #4	Overcoming Diverse Barriers with Technology-Enabled Education: Case Studies
Session #5	Technology-Enabled Education Applied to Academic Courses: Science, Engineering and Mathematics
Session #6	The Internet and Education: Case Studies from around the World, Part 2
Session #7	Technology-Enabled Education for Pre-University Students: MIT BLOSSOMS and other K-12 Programs
Session #8	Creative Use of Social Media in Technology-Enabled Education
Session #9	Organizational Design Requirements for Successful E-Learning
Session #10	The Critical Role of Teacher in Successful Technology-Enabled Education

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Parallel Presentations

Session #1
The Internet and Education: Case Studies from around the World, Part 1

- "Five Trends of Educational Change: Reshaping the Humanity with Global Network Tools" presented by Dr. Mikhail Bukhtoyarov and Anna Bukhtoyarova (Russia)
- "E-learning: Enabling the Differently Able People in India" presented by Nidhi Garg
- "Opportunities and Challenges for Open Educational Resources and Massive Open Online Courses: The Case of Nigeria" by Babatunde Ipaye.
- "Technology, Education and Emerging Economies" presented by Veena Kapur
- "The Realities of Operating an Open University in Sub-Saharan Africa" presented by Magreth Mushi and Jabiri Bakari (Tanzania)
- "Access to Internet Connectivity: the Major Bottleneck to the Adoption of Technology-Enabled Education (The Case of KNUST)" presented by R. K. Okine and J.S. Marfo (Ghana)
- "Impediments to Bringing Education to ALL" presented by Dr. M. Padmavathi (India)

Five Trends of Educational Change: Reshaping the Humanity with Global Network Tools

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Abstract

The paper is aimed at exploring the change in educational paradigm with respect to the Internet technologies. It defines five major trends that lead to emerging the global system of education. The authors discuss the possible ways to deal with the changes on the local and global scale.

1. Introduction

The growth of the Internet during the recent years has become a significant factor of social, economical, political, and cultural life of the humanity. More than one third of the world population has become Internet users (according to the Internet World Stats site).

This article is aimed at defining and discussing current trends of the global educational change with respect to the Internet. In our opinion current major change in education is a step to the new global educational system. We believe that it can transform the modern society.

Most countries in the world are getting through the process of integrating the information technologies into their national education systems. This integration is a necessary step towards what we call "information society" or "digital society". This theoretical construction that has been developed in the recent decades and implies such key educational concepts as information literacy [1], lifelong learning [2], and collaboration [3].

Defining the trends of the global educational change we have to take into account that the Internet challenges the traditional systems of education in several ways:

- The requirements of the society and business to the human capital now include competencies related to the extensive use of the Internet technologies, information literacy and productive forms of collaboration. Meanwhile it is increasingly difficult to work out a new set of educational standards for the changing environment.
- Though the emerging technologies are replacing some of the social and educational functions of schools, they are providing schools with new tools. Those who take risks are able to participate in a continuous set of experiments as most of these tools are being developed and tested on the fly.
- Various forms of distance education and e-learning have made education available to the large number of people regardless of their physical location, age, gender, etc. Thus, schools and universities have to develop new learning practices based on these technologies and they face global competition.

Today numerous international educational initiatives in the Internet are supported by national governments, international organizations, NGOs and NCOs, various types of national and international businesses and other types of global actors. There are also groups of individuals who volunteer over the Internet and unite in self-organized learning and teaching communities.

The big question is about what they are bringing into our world.

Our objectives as the researchers are:

- to define some trends of global educational change by analyzing current practices of international Internet-based initiatives and
- to raise the discussion on their possible impact on education globally and their potential to cause significant social change in future.

2. Research methods and technique

As this research is aimed at defining major trends of global educational change it is being performed by observing and analysis of the current practices used by the Internet-based educational initiatives. That is why the research data comes from a large number of sources from all over the world: web sites of international educational initiatives, especially forums, educators' blogs, communication with the members of teaching community based on Skype in the Classroom global initiative, observing the major MOOC web sites (coursera.org and edX.org) as well as our personal four year experience in teaching through the Internet. As most of that data is hard to be structured in quantitative format and verified in that way, qualitative evaluation is being used as a main technique. At this stage we consider our findings to be hypotheses.

3. The five trends

We consider the following trends to be significant for the national systems of education as they may become the basis for the emerging global educational system:

1. Massive open online courses (MOOCs) provide either free or relatively inexpensive education that can be compared to traditional face-to-face forms of learning in terms of quality and effectiveness of training. During the recent years, being based on the latest Web 2.0 technologies, they have became one of the major trends in distance education. Such courses, especially college-level ones, can easily start working as powerful human resource management tools and effective employment filters for global actors (states and corporations). The extensive use of MOOCs can be potentially dangerous to national systems of education and to local employers in less developed countries due to the fact that they can simplify the mobility of human resources to different parts of the world. Such initiatives as Khan Academy, Coursera, edX with millions of users worldwide prove that large numbers of people can be involved in transnational educational process in a relatively short period of time. Massive open online courses are pushing national educational systems to urgent change so that they can face this global challenge.
2. Emerging self-regulated educational online communities rely on the technologies and web services that provide peer-to-peer communication and interaction. They can congregate around social networks, forums, blogs, micro-blogs, podcast sites, video-on-demand services, wikis, and even around audio and video conferencing tools (such as Skype and Google Hangouts). These virtual communities have most of the features of the constructivists' "communities of inquiry" but they can often utilize non-systemic "crowdsourcing" approach to communication, organization and learning. These communities emerge either in response to some specific educational needs, or just as a result of sharing common views and ideas among enthusiasts. Their members take part in multiple peer-to-peer individual of group learning practices. Online volunteer teaching

and online educational collaborative projects have become popular and are expanding rapidly. Their members share cross-cultural and cross-disciplinary educational experience with their audience. Our two-year experience of participation in one of such online communities together with 150 international educators has proved that these forms of collaboration can provide various types of effective educational activities.

3. Creation and utilization of open knowledge bases such as Wikipedia is a part of the new educational reality. Wikipedia has become an outstanding example of successful global knowledge-sharing project based on crowdsourcing ideology. Though there can be multiple ways of using knowledge bases, that are potentially harmful for the traditional academia (online banks of quiz answers and written assignments, massive plagiarism, common source of answers to most questions, etc.), these tools can serve to create and organize domains of knowledge for individual and group learning purposes. On a global scale the positive way of using this technology is that it can become the basis of better mutual understanding and agreement on multiple topics. In the long run it can be the source of building a universal ontology with a developed system of categories and classifications. The positive or negative aspects of such powerful tools can be debatable.
4. The main foundations of modern educational philosophy are moving from constructivism to connectivism. While the first one puts an emphasis on individual knowledge and skills acquired through gaining social experience, the second one focuses on collective knowledge developing though growing of the network. We agree with the statement that “Connectivism allows the future of education to be viewed in an optimistic, almost utopian perspective, as individuals co-create knowledge in a global, networked environment” [4]. In this new setting teaching can change its meaning and become either a motivation and facilitation activity for face-to-face classes, or an art of online consultation and a mediation service. Connectivist learning in our opinion can be the core of the knowledge society.
5. Education becomes a highly fragmented process of utilizing a constantly changing set of tools alongside with shifting roles of the individuals who participate in it according to their interests and abilities. As modern learners utilize global educational services they can choose out of many alternatives. They can learn at any time and at any place. Learning becomes virtually an “on-demand” service. A learner's educational experience is a unique self-made product based on numerous choices made while moving along the individual learning path. The limits of this process are the time available for the learning activities and the technical facilities. This specifics of the modern educational process requires new forms of tracking a learner’s individual achievements. It is also a challenge to the educational standards. Individual learning paths can be traced either through an online portfolio of the learner or through his/her social network profile with a timeline that would present participation in some relevant activities and projects that can be viewed as milestones of the personal and professional development. On this way motivation for global competition and global activities becomes inevitable. Most of the today's learners have the whole spectrum of opportunities to compare their skills and knowledge with their peers in various international projects. After being graded on a global scale there is no way to avoid the knowledge of belonging to the global educational community and to get back to the local scale.

4. Local perspectives: a view from Russia

Russian education inherits most characteristic features of the outdated Soviet educational system. In our opinion its most important differences from the US are the following:

- the system of education mostly relies on public schools and universities: according to most recent information available on the *Russian Educational Statistics* website the absolute majority of children (more than 99%) attend public schools, and the majority of students (more that 85%) attend public universities [5],
- there are federal standards for all the levels of education which makes educational system highly unified and dependent on the decisions of the federal government,
- both school and university students have very few elective courses in their curricula,
- academic culture is relatively conservative and does not motivate students for fair and responsible learning and independent decision making.

Currently the college and university education in Russia is being transformed to meet the requirements of the Bologna Agreement that makes the national system of education closer to the European standards. For example, the European system of academic degrees and grading system has been recently introduced in Russian universities. But there is still very much local specifics that make Russian education very traditional and hard to change.

However, the global trends have already made this change inevitable:

1. The trend that currently has the strongest influence on Russian education is emerging of open knowledge bases where learners can share information and publish the results of their intellectual work. The influence of such online resources is ambivalent:
    a. On the one hand due to extensive information sharing among students the level of plagiarism in Russian school and academia has raised to an extremely high level and it has currently become a threat to the quality of professional education in Russia [6].
    b. On the other hand the tendency of sharing the latest information among people and creation of such popular knowledge bases with structured content as Wikipedia make students aware of topics that are not represented in Russian language through other media. Different points of view that can be introduced in the process of collaboration and they encourage multiple discussions. Even the topic of growing plagiarism has made a positive impact on Russian academic culture because it has drawn public attention to the unresolved problem and now the large audience, including the Russian Ministry of Education and Science, is working on a solution [7].
2. The second important trend for changing Russian education is self-regulated online learning communities. In our opinion, the traditional collectivist culture of Russian society can be strongly influenced by such way of learning and sharing educational experience. During the recent few years Russia is experiencing the boom of blogging, social networking and other Web 2.0 services. Social media have become a part of modern academic culture. Self-regulated communities appear in all the social spheres: politics, culture, trade. Education is not an exception. Learning communities appear in *VK.com* that is the most popular social network in Russia and on professional community websites, such as *Habrahabr.ru* for IT professionals. Meanwhile, educational websites are not so popular in Russia. Global educational initiatives are also not very common due to the limited number of English-speaking population. Nevertheless, Russian government is trying to stimulate growth of educational initiatives on the Internet and even uses

crowdsourcing methods in legislation. For example, the new Law on Education was published as a draft in 2010 for open peer review and online discussion.

3. The third trend that can be the reason of a big change in Russian education is the MOOCs. Currently, there are very few massive open online courses available in Russian and their effect is not significant. But even courses in English can be viewed as a potential threat to the national system of higher education. There are several reasons for that:
    a. Students and professionals demonstrate growing interest to the MOOCs and try to use them to improve their knowledge of the subject and their language skills. We think that when popularity of such courses grows they can become the reason of brain drain from Russian educational and labour market as the most talented students will have more options to choose and more opportunities to prepare for educational or professional immigration. If MOOCs will be available for school curricula they can cause even bigger consequences.
    b. Being involved in MOOCs students compare the content and the curricula of the courses from the top world universities to what they can get at their home universities. This comparison raises justified demand for better quality from their national system of education and draws Russian education into competition with global trendsetters. Russian educators have already started discussion about the potential threat of global education and necessity to preserve the national education.
    c. Traditional Russian academic culture is being influenced by the standards of the online courses as students bring new vision of learning into the classroom. Those who have participated (even tried) online learning become aware of pedagogical approaches other than the ones they have in their home country.
    d. Professional community (at least in the IT sphere) is discussing the necessity of MOOCs as a prospective tool for professional development. This discussion has not become extensive yet, but it can grow with the expansion of online courses and their availability in Russian language.
4. The fourth important trend is the very idea of "on demand learning" that implies the concept of individual learning path. Russian education, as it was stated above, has very paternalistic pattern: students have few elective courses and the educational process is based on completing the state (federal state) requirements for every level of education. The existing subject-centered approach makes the learner a passive recipient of knowledge and develop a predetermined set of skills required by the national educational standards. Online learning opportunities give Russian students educational freedom that can help them think about variety of options and make choices. We would rank this trend as the most important but only after there are observable achievements. The process of change has just started.
5. The fifth trend, the connectivism, has deep roots in Russian pedagogy and philosophical tradition. That is why we think that the emerging philosophy of online learning communities and the tools for effective collaborative learning can match Russian cultural specifics without causing an IT culture conflict described by Dorothy Leidner and Timothy Kayworth [8]. On the other hand the students' passion for online collaboration and interaction needs to be adequately understood by national education stakeholders and properly supported by the national educational community. The young generation

of Russian learners who fall under Marc Prensky's definition of "digital natives" have to learn according to the rules and standards developed by "digital immigrants" who are not completely integrated into the new digital culture [9]. This can be the reason of a major cultural conflict in Russian society. A lot of social and political events in modern Russia make us think that this conflict is already developing.

5. Personal experience

These five trends guide us in our professional life which makes us agents of the global educational change.

Since 2012 we have been participating in several MOOCs and consulting our students on the topics related to this global initiative. We are also carefully observing the public reaction to MOOCs in Runet (Russian Internet) and among our students. The information about MOOCs in the news, blogs, social networks, discussions demonstrates growing public interest to the topic. Our long-term goal is to urge Russian educators to participate in this global initiative providing their courses to the international educational audience in English language and to make massive open online courses available in Russian language. We think that if MOOCs were officially recognized by the national systems of education they could become a source of full scale educational collaboration of nations.

We have also been active participants of an international online community called "HLW Skypers" that includes more than 150 educators from different countries. The main goal of the community is to share professional experience and provide online classes exchange via Skype and Google Hangout. There are numerous international initiatives inside the community such as videolectures, blog and website competitions, peer tutoring, etc. The community started in 2010 through the means of the professional social network *Skype in the Classroom* and has grown into a full scale collaboration project. We participate in other educational communities based on social networks and forums discussing professional topics, sharing experiences and exchanging resources.

Utilization of open knowledge bases is a part of our professional life because most of our students use Wikipedia and similar web resources on regular basis. To help them find, understand and assess the information from open sources we have to include them in our curricula. Moreover, we encourage our students to use Wikipedia as the platform for their projects (writing and verifying articles, doing research on topics related to Wikipedia and its rules).

Working with students who belong to the digital natives generation is often a challenge for us because our students have naturally become a part of the global social network where individual knowledge and personal emotions are shared with enormous speed. A learner on the network is more than an individual learner. From the social networks perspective an act of sharing and exchanging information is equal to the process of creation. Sharing an idea becomes an act of collective thinking. Supporting this idea becomes an action. We, as teachers, can be a part of this network, helping individual ideas grow into an unbelievably complex intellectual process. In our opinion it is extremely important to support this philosophy of collective thinking. Connectivism may bring a global shift to the human society.

Nevertheless, an individual can face a problem of finding his/her learning path in the chaos of multiplication of knowledge. Our students, especially school children, struggle with growing information flow. In Russia we have overcome digital divide for significant part of the population, but the new problem for the students of the Information Age is the lack of time. There is growing inequality between those who have time to use open educational opportunities and those who are either overloaded with multiple tasks, activities, extra courses or simply have no time management skills. We are trying to find tools that can help them cope with both problems. The other challenge is to make the individual learning path traceable and officially recognized. This is one more important task for us as educators.

6. Recommendations

To meet the current challenges the national systems of education should be open to the global opportunities that emerge due to the new technologies. We believe that building the information society, the society of knowledge can be based on open and equally available education. That is why we suggest the following set of recommendations:

1. First, the national systems of education should actively participate in such international initiatives as MOOCs and start their own national and regional courses. This is the only way to promote proper level of localization and protect national interests without staying off the mainstream development of educational technologies. The regional and national alternatives to the existing projects are necessary.
2. Second, we need to initiate an in-depth research of self-organized educational online communities as they are becoming an important part of global education that can either compliment or oppose the national and global systems of education. Some of such groups can become a part of students' and teachers' training curricula.
3. Third, as open knowledge bases are having large impact on learning process, we need define their place in individual and collective thinking, work out proper use policies for academic purposes and integrate them into our education process. Such bases are usually perceived as a threat to the traditional academia but they are effectively used in some innovative courses and by the self-organized learning communities.
4. Fourth, motivation for global competition has already become a part of modern life. National systems of education would gain much more if they could be more active in international and regional collaborative projects.
5. Fifth, some elements of non-systemic education, the variety of on-demand learning activities should become a recognized part of educational process and be included into certified programs and curricula after having a proper level of evaluation.

7. Conclusion

The new paradigm of education relies largely on innovations in the IT sphere that have become available in the recent decades and have introduced new models of interpersonal activities and group interactions. These models are introduced on IT market and are quickly adopted by consumers through social networks, collaboration tools, management tools, and various popular Web services. Some educators have already started using these tools in their practices at their own risk and without integrating them into the official school programs. National systems of education have only few years left to transform and meet the requirements of the Information Age. We think that it is the time for a big change.

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Her research focuses on the impact of globalization in education and new ways of teaching/ learning based on the current trends in instructional technology.

E-learning: Enabling the Differently Able People in India

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Abstract

With this paper we bring into light the advances in literacy of the physically and mentally challenged in India. The mode of spreading education synthesized here is primarily e-learning. E-learning or Electronic learning incorporates the use of interactive video conferencing, virtual classrooms, satellites and education channels on televisions in the remote and rural areas. The areas are usually scant in education infrastructure, classrooms, skilled teachers, electricity and communication with nearby developed cities. The developing countries are home to 80% of world's disabled population. Education comes as a ray of hope, as it opens door to knowledge, employment, independence and self-worth. The government's initiatives and the private organizations role in this movement are analyze, the outcomes and future prospects are studied and concluded.

Introduction

There are 400 million people [1] with varying physical or mental disability in Asia. Out of these, 250 million is in the age group of 13-35 years which is also the working group. Most of them are in rural areas with not more ten percent getting sustainable employment. Their growth is hampered at primary level only. Social stigmas, poverty and lack of self-motivation to grow and become self-dependent are other factors which hinder their progress.

Literacy is the ability to read and write. With advancements in technology on national basis, various programmes have been started for the promotion of education among people living in different parts of India. There are areas where there is unavailability of proper schooling facility for normal students, so taking. In the under developed areas, people are unable to take any governmental help and are least interested in taking benefits from it due to lack of awareness. The e-learning programmes like the ones started by the first Indian educational satellite EDUSAT [5], National Blind Association, Sarv Shiksha Abhiyan [6] etc are changing the lives of many and also generating employment in remote areas.

One of the present popular IT technologies is e-learning. It has grown as a tool to educate one and all. It supports the notion of education anytime, anywhere and for anyone. It is irrespective of the community, region and monetary capacity of the student. The regional governments are facilitating various non-government organizations to come forth and spread literacy amongst the incapable masses. Evening schools, television channels, radio broadcasts are made. The people, who can use only one of their senses to communicate with others, are provided digital aid. This helps them in understanding the syllabus of any course they wish to study, and it is also available at any time of the day. The needs of a skilled trainer for the deaf and dumb are now altered with mobile messaging and chat systems.

India's is a federal government with 28 states and 7 union territories [2]. There are huge differences in the literacy rates in each state. As per NHFS-3 released on 11 0ct 2007 India as a whole has the literacy rate of 74.04% [3]. This varies acutely from north to south and east to west. The state of Kerala has the highest literacy rate equal to 93.03% [3] whereas the state of Bihar has 63.08% [3] literacy. This is also the effect of the respective government's initiative towards education.

The state governments in the southern states of India have facilitated development of the Information Technology and Communication sector in the country for the spread of education to remote areas as well as below poverty line families. The physically challenged have to face various problems to go to any institute for studies. Even if they go, poor infrastructures like lack of low floor buses, ramp to move the wheelchair, escalators etc hamper their movement. At school level, the availability of skilled teachers to understand individual kid's need is impractical. These special children still manage to attain education till high school. After this, 3% reservation is given to them by government in all government institutions. The seats are very few as compared to the need and these also are filled on the basis of quota system and their scores at high school level. E-learning has helped such students to attain literacy and become self proficient.

The disabled are benefited by the state governments too. Since there are huge state wise variations in the dialects, occupations and growth opportunities, the transfer of skilled teachers from one region to another is hampered by the language they use to communicate. India has officially 22 languages and nearly 415 [7] local languages spoken in different parts of the country. People from one region in the same state are unable to communicate with each other. This leads to development of one region only and no traversing of the knowledge takes place. Poor education, health care, recreation activities, housing and economic activities remain undeveloped.

2. Population statistics

India stands second in the world with a still growing 1.21 billion population. The youth brigade has crossed the count of 808 million. It has the largest population in the working age group. It can change the face of the country and world on a broader perspective. Fig.1 shows the graph of population crossing different age groups. It clearly defines that the number of youth in the total population of India is the most. So while taking any decision the government has to take every possible step to utilize this man force in the best possible way. This paved the way that the disable people of this age group should be given special importance so that they can complete their basic education. Education will not only open the doors for higher intellect but will make them more motivated and self-confident. This will further lead to self-dependency in the profession that they opt for. So rather than becoming a burden to their family, friends or society they live a happy prosperous life and contribute in the development of society and country.

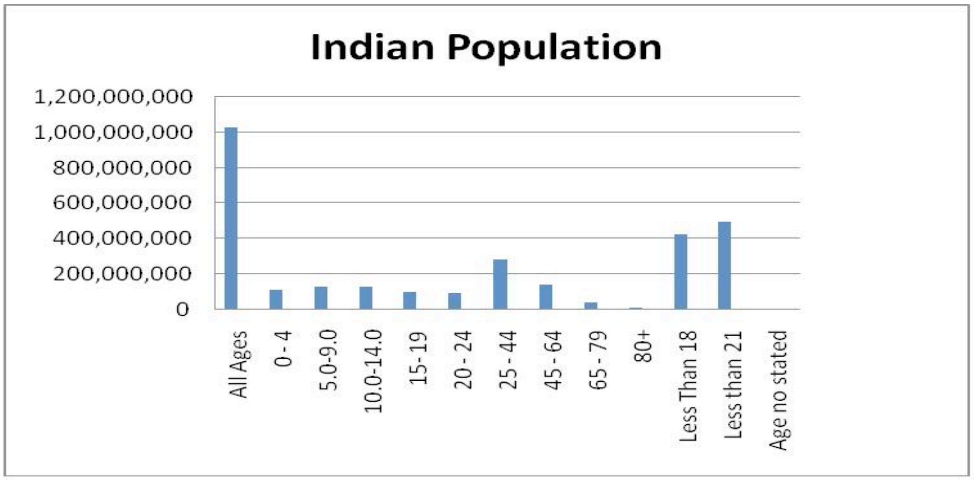

Fig1: Distribution of Overall Population in India

3. Distribution of disability

The South Asian countries are all developing and share common political, geographical and development perspectives. They all face similar growth and developmental problems. They all have large populations, slow development rate, brain drain, poor health facilities and a huge range of natural calamities. Many of the disabled are from birth; some get certain ailment at an age and acquire disability at that age. Many accident and calamity situations also generate physical or mental ailments. [9][10] Figure 2 shows the total population and population with physical or mental disabilities on a scale. It points towards the fact that India and Bangladesh have the most disabled people.

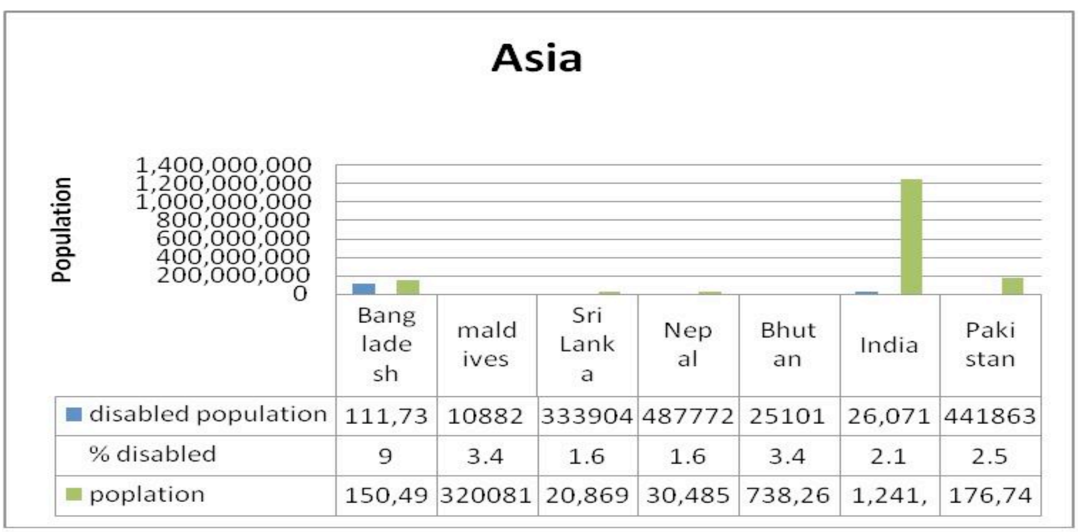

Fig 2: Comparison of Disabled people in Asia with Overall Population

A graph in figure 3 shows the percentage of people in distinct age groups facing single or multiple physical or mental disability.

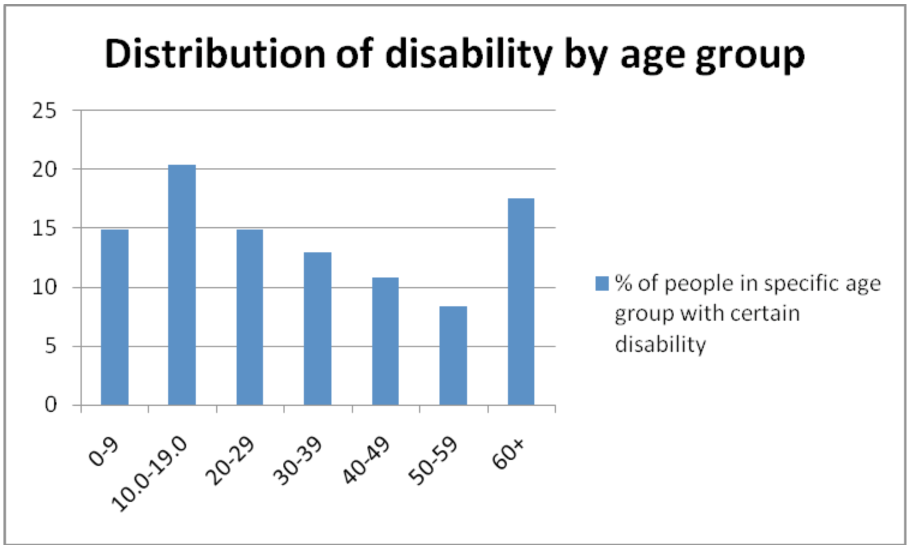

Fig 3: Distribution of Disabled people in India

Working age group has the highest population facing certain ailment.The elderly comprise more than 15% of the unprivilged population. They need physical/mental as well as emotioinal support to feel self worth. The senior citzens have a steep literacy rate, they do not contribute in the community's development.[11]They require care-takers.Along with one disabled person, more than one person is being affected. However, the working group comprises of people, who are in charge of there family's monetary situations.They are the earning source for their families and face quantum problems in even applying for a job. There is 3% reservations for such people in government jobs.1% each for people with visual problem, hearing or speech impairment,autism,cerebral palsy and mental illness. [12]

Figure 4 demonstrates the division on the basis of various ailments in rural and urban India. The graph in the long run, helps to understand the attainment of jobs by such differently abled people in the country.[13,14] It shows that most of the population has locomotion problems, hearing or vision related ailments. The people who can move only with external support, are not able to attend schools and colleges as the required ramps are unavailable. They are trained in specialized schools. They can learn by sitting at one place. If computers are provided to them, and web based seminars are conducted, they can get exposure to other cities and countries. They can themselves become tuttors to others like using these technologies. The people with mental illness and retardation are considered specially because each of them have an individual , different problem and manner of responding. Their schools are adopting e-technology, here they are using virtual classrooms and animations to make it more student friendly and entertaining. Narayan seva sansthan, is an NGO in Udaipur,Rajasthan(the largest state of India). It provides financial aid to disabled people for medicine and operation purposes. Mother Teresa Home in Jaipur is also providing food , shelter and medical facilities to such people. They are also educating them.

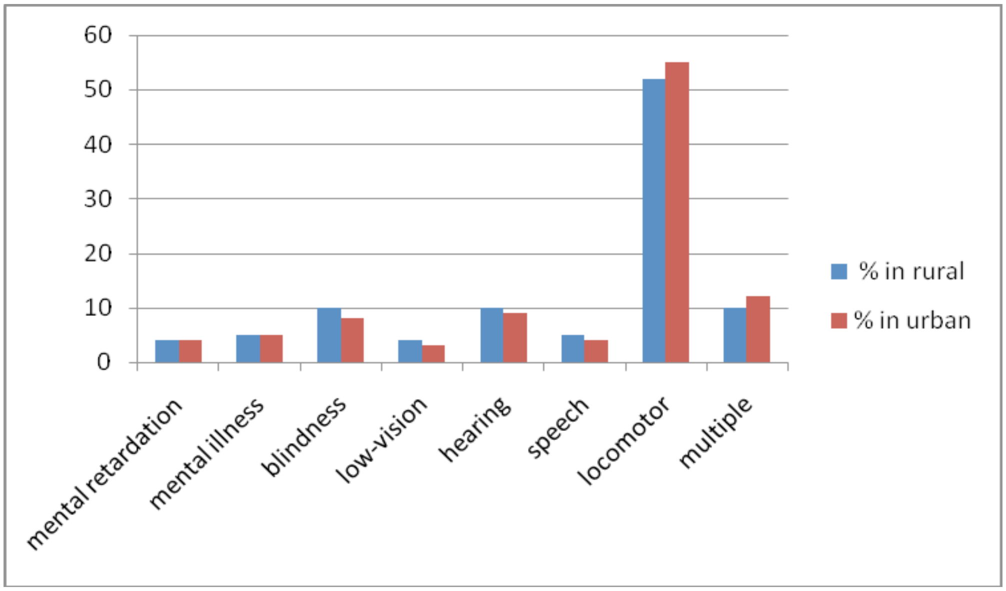

Fig 4: Different types of Disability in Rural and Urban Population

Figure 5 shows distribution by type of disability amongst the population of differently abled people. The visual impairment is the biggest problem faced. India Legal blindness is defined as visual acuity of not greater than 20/200 in the better eye with best correction or a visual field of less than 20 degrees [15, 16]. Legal blindness can mean tunnel vision, no central vision, cloudy or extremely blurred vision, seeing just shadows, or no vision at all. For this purpose, National Blind Association is doing significant work in Valsad Gujarat. It has established labs for the blind in 2002. Here the visually impaired people are first trained to use the computer systems using braille technique. After this, these people work on small projects. One such project is to convert huge collections of data,books, magazines and other readable matter into hearable format. This helps other blind people to access the huge e-library over the internet.[17]

3. Education statistics of the disabled people

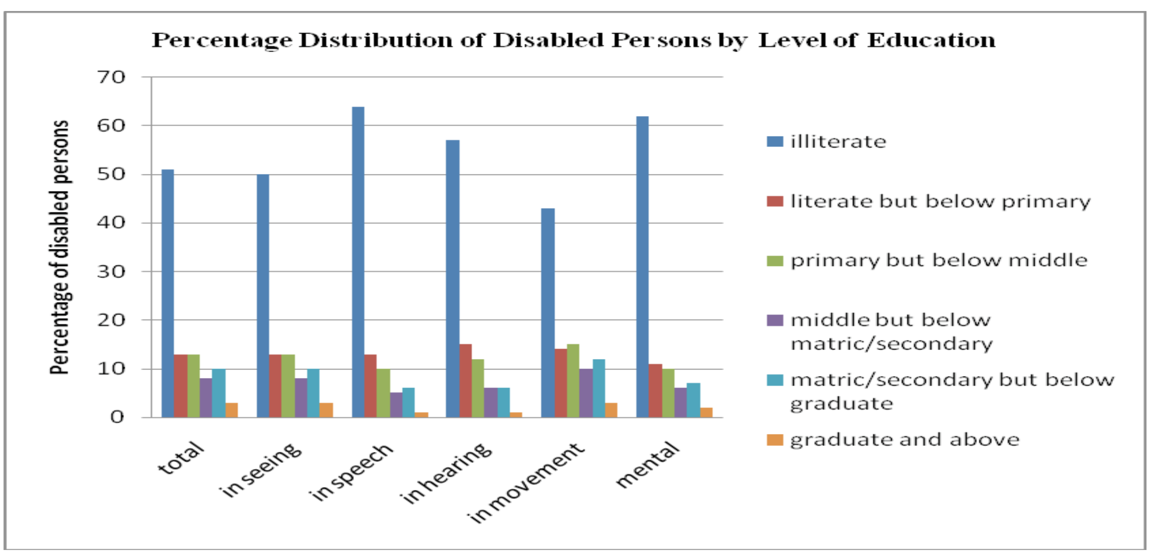

Fig 5: Percentage Distribution of Disabled Persons by Level of Education

The figure shows a graph of the variations in the education level on the basis of disability. The above graph points towards a high illiteracy rate amongst this population. The individual level of education attained by each group is shown in a two-dimensional manner. Each group with individual percentage of different education level can be monitored. Though the average literacy is 50%, variations can be seen in the education of locomotive troubles facing people and speech disabled people. The earlier group has 58% literacy. A very few are graduates. All other attained education only below matriculate.35% of them has education below matriculation. Nearly 3% are graduates. 37% of the people with speech ailments are literate. Majority of them attended school below primary level and a scarce number are graduates. 39% of the mentally disabled people are literate. They show varying numbers at different levels of education. People with hearing disability, had education not above middle school. 50% blinds are literate. They show the highest number of graduates. On an average, they have completed secondary schools.

In 2001, only 38% females and 57% males were reported to be literate. Most of them have education till primary classes (11%). 9% have education up till middle classes. Merely 2% are graduates. This indicates a poor level of technical or vocational education. The number of completely disabled people is larger than partially disabled. Their recruitment agencies and colleges also give preference to partially disabled people. By this level of education, government or private jobs are unattainable. [18, 19] In the past 11 years, there is significant change in the level of awareness and resources available to such people.

4. E-education for the disabled

4.1 Technology for the Blind

EDUSAT is India's first satellite dedicated towards the spread of education in remote areas. It is a geo-synchronous satellite and provides relay of educational channels on television throughout the day. It has 5 ku beams. Southern, northern, eastern, north-eastern and western beam. Presently it is providing coaching to 50 universities covered by these 5 beams. It enables video conferencing and online seminars too. Through video conferencing, classroom coaching is provided. The students must attend the class to reciprocate the tutor's coaching. It also provides soft copies of books, videos, audios etc. [39, 40, 41]

The most innovative mode of teaching provided by EDUSAT is the network for blind schools. At Ahmadabad Gujarat, Blind People's Association has set up blind schools. EDUSAT is delivering live audio and data which is read by a blind person through its printed impression. It provides education from 1st to 10th standard. It has also setup a Braille Language Lab. Over 2,000 students in 10 schools across Gujarat are being taught mathematics, science, social science and Hindi for their board examinations. ISRO is planning to extend the project to other states.

4.2 JAWS

Job Access with Speech is computer software. It speaks out all the matter written on the computer screen. It enables a blind person to work on Microsoft word, access internet etc.

4.3 Daisy Forum of India

It is an NGO involved in the production of books and reading materials for people unable to read the normal print. They help the disabled to attain books and other material in accessible format. The alternative methods to print are Braille, Talking Books, E-Text and Large Print. With the computerization of the Braille, production has been accepted method in all parts of the world. The Talking Books convert analog data into digital data and provides talking books which are recorded using computers and saved into CDs.

E-text helps in reading the computer screen for persons with blindness or print disabilities. The electronic text can be enlarged on a computer in e-text has made large print production easier than ever before.

4.4 Technology for deaf

National Association for deaf is an NGO with nearly 2500 members from across the country. It organizes coaching classes for them and also organizes meetings at national level. [42, 43]

Deaf Child India is a project by Nambikkai Foundation. It provides information technology training and access to deaf children in the state of Tamil Nadu. They develop text-books and other learning material which can be used by the deaf people.

4.5 Technology for autism [44]

Centre for Development of Advanced Computing (C-DAC) [45] is developing tools to facilitate learning for such specially gifted children. It involves multimedia and colorful presentations to involve students in such computer games. These tools access the student's progress and customizes the methods to suit the student's needs.

5. E-learning initiatives by government, corporate and NGOs:

There are a number of ventures in the field of educating the unprivileged people in remote areas of India by the use of electronic medium and technologies. There are certain state wise programmes initiated for it. Some of these are ERNET, GYAN-DARSHAN, IGNOU Doordarshan Telecast, INFLIBNET, Talking Kiosks etc.[20,21,22,23,24,25,26,27,28]

5.1 Gramjyoti

Ericsson has set up broadband network across 18 villages and 15 towns of the state Tamil Nadu. Its aim is to facilitate education using high speed internet bandwidth across villages. Community centers equipped with PCs and 3G mobile handsets and also provided teachers at their Chennai office to deliver education through internet. [29, 30]

5.2 Gyandoot

It is started by the Government of Madhya Pradesh. Here intranet facilities have been set up to connect the rural cyber cafes. It has set up 32 kiosks in high schools and higher secondary schools of Dhar District. Through these, the students are taught the courses of class X & XII. The students can share data and the question bank created by the experts. [31, 32]

5.3 Byrraju Foundation

The initiative is IBM Kid Smart Early Learning Programme. In the year 2004, Byrraju Foundation partnered with IBM India and deployed the technology to 142 villages of rural Andhra Pradesh. It spanned across six districts of Guntur, Ranga Reddy, East & West Godavari, Hyderabad and Krishna. [33, 34]

5.4 AKSHYA, Kerala

Project AKSHYA was launched in 2002 by Government of Kerala. It promotes basic computer usage among rural masses. The project aimed to establish 5000 multi-purpose AKSHYA e-centers across Kerala which are run by private entrepreneurs. [35, 36]

5.5 AAROHI, Uttaranchal

The project is started by Uttaranchal Government in partnership with Microsoft, Intel to provide basic computer education to all Government and Government aided schools from Class VI – XII.1206 Government and 281 aided schools are covered. Microsoft further plans to enhance computer literacy in the states of Kerala and Uttaranchal by imparting computer education to 80,000 teachers and 35 lacks students. [37, 38]

6. Work of authors

Mrs. Gayatri Gupta, a Senior Teacher in government school in India, has served for 21 years in rural as well as the urban schools of Rajasthan. She is very well acquainted with the problems and governmental aids provided to such people. The basic level and standard of education provided to the people with special needs is unsatisfactory. There are very less specialized schools in India which provides a quality education to disabled students. She has researched about the different specialized schools in Jaipur, Rajasthan and the status of literacy level of such students at primary level.

Dr. Shakuntala Garg, an Associate Professor in government college, with an experience of 28 years, got all the statistics regarding the disabled student's literacy records of 2001-2011. The government schemes, funds and reservations provided at college level are not at par with the bulk disabled population. She rigorously researched about the different government and non government organizations aided schemes for the education of rural, women and differently able people.

Rahul Gupta is senior undergraduate student pursuing Bachelor of Engineering (BE) at MIT Manipal, India. As his specialization is in Information Technology, he had the vigor to accumulate information about the varied e-learning modes used in India for the advancement of the less developed masses. These masses comprise the rural India, below poverty line families and the disabled people in rural and urban areas. He has published 22 research papers and is working with more than 5 NGO's to create awareness about science in the young children.

Nidhi Garg is senior undergraduate student at JNU, Jaipur, India. She is pursuing Engineering in Computer Science and has visited different specialized schools in the state and gathered data about on how much electronic education is aiding the literacy of the disabled people. The results showed that the government's attempt to provide education through computers and internet is not reaching the masses and a lot of improvement is needed in the infrastructure.

7. Present and Future Prospects

The virtual classrooms, web seminars and video conferencing are successfully implemented in more than thousands of schools and local areas in the country. Currently, e-learning is being used to teach the people living in remote areas of India. Various IT companies are coming forward and starting with e-learning programmes too. They have introduced technologies to help the unable people communicate properly using various electronic devices.

Haptic interfaces [46] in computer devices, which involve non-verbal communication using touch help the blind and people who sense by touching to operate a computer device are introduced. Numerous keyboard shortcuts, hotkeys and compatible screen readers are available to make human computer interface easy for such people. In the future, these technologies appear to boom and become accessible by more number of people.
The government of India has passed two bills i.e. Rehabilitation Council of India Bill and the Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act. These in collaboration with government and non-government agencies are providing resources and other amenities for the education of such people.

8. Conclusion

E-learning is touching lives of millions of Indians, transforming the outlook of the variedly challenged people in a developing country. Those regions which are inaccessible by vehicles are now getting directions through online seminars on first-aid, general mathematics and also, information on the onset of any disaster.
The population is grand; the present work appears to be a drop of water in the sea. The government's attempts are in accordance with the state governments, a lot time is wasted in collaborations and other formalities. A centralized attempt is needed. Foreign aid along with multi-national companies is trying to provide resources to the backward areas in our country. Surprisingly, the attempts made by the national and local governments lag behind and are incompetent with them. Even if proper education is provided to the disabled people using technology, two way developments will foster. One is the individual will become self-sufficient and second less dependency on someone else for their basic needs will decrease. It will not only enhance their lives, but the country as a whole.

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Opportunities and Challenges for Open Educational Resources and Massive Open Online Courses: The Case of Nigeria.

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Abstract:

The last few decades have seen a phenomenal increase in the provision of higher education in almost all parts of Africa. Higher Educational Institutions, HEI, have been on an upward progression. Besides publicly funded HEI, private–sector participation in the provision of HE has increased and this includes for-profit and not-for-profit organizations, public–private partnerships, international and intergovernmental agencies. In Nigeria, for example, the number of universities has increased from 41 in 1998/1999 academic year to 125 in the 2011/2012 academic year. Private universities rose from three in 1999 to 50 in 2012 and the NUC has decided to license more private universities in 2013. In addition, some individuals within the country are already planning to float a completely on-line HEI, hoping to take advantage of the rapidly increasing access to the Internet, World Wide Web and whole range of fast and intelligent ICTs. Many of such would-be providers hinge their hope for study materials on the fact that educators, academics etc are now prepared to share their life experiences and knowledge, with others, through a variety of social media, Wiki educator and particularly the Open Educational Resources, OER. In fact, some are planning to latch on to the Open Educational Resources University, OERu. This paper examines the opportunities as well as the challenges of OER in relation to higher education in a developing country like Nigeria, a country where for the past two decades, the conventional universities have not been able to absorb more than 12% of the qualified applicants each year. In doing so, this paper investigates the extent of awareness and use of, as well as willingness to adopt OER in the country. It also tries to find out if there are any OER policies at the governmental and institutional levels and what such policies are focused on. The paper also looks at the most recent development in on-line education, i.e. the Massive Open Online Materials, MOOCs and what it means for higher education in Nigeria. It ends with some recommendations, not only for Nigeria but also for developing nations generally.

Keywords: open educational resources, distance education, higher education, MOOC, internet, social media.

List of Acronyms/Abbreviations

COL	Commonwealth of Learning
HEI	higher education institution(s)
ICDE	International Council for Open and Distance Education
ICT	information and communication technology/technologies
MOOCs	massive open online courses MIT Massachusetts institute of technolog
NOUN	National Open University of Nigeria
NPC	National Population Commission
NUC	National Universities Commission
OCW	open courseware (can also refer to OpenCourseWare at MIT)
OECD	organisation for Economic co-operation and developmen
OER	open educational resource(s)
OERTen	OER Tertiary Education Network
OERu	OER university
OLCOS	Open e-Learning Content Observatory Services
RETRIDAL	Regional Institute for Training and Research in Open and Distance Learning

Introduction.

As of February 2013, there were 128 universities in Nigeria. 40 of these are Federal, 38 are State and 50 are Private universities. The growth of universities, especially private universities, in Nigeria is very dynamic as it keeps increasing by the day. With the addition of three Federal universities early in 2013, every State of the Federation now has a Federal university and there is the probability that increases in this area may now stop. This is because the Federal government's policy is to have only one Federal university in each State, except where there are Federal specialized universities - such as universities of Agriculture, universities of Technology or open universities. Again, the increase of State universities may now slow; there are 36 States in the Federation, though a few States already have two or more universities. However, the National Universities Commission, NUC, the regulatory body for the growth and development of universities in Nigeria, has promised to license more private universities in the future; hence we should expect more private universities.

It is quite obvious that 128 universities is still too small a number for a country with a population of 150 million or more, 78.2% of which fall below the age of 35, indicating a rather youthful population. (NPC, 1997)[1] This argument is supported by the fact that for more than a decade now, the conventional universities all together have not been able to absorb more than a maximum, each year, of 15% of the total qualified candidates applying for enrolment in the universities. The simple reason for this has been that brick and mortar universities have limited carrying capacities. Yet there is a well-founded and widespread suspicion, if not fear, of distance education in the country - based on recent experiences with outreach campuses and part-time degree programmes.

Nigeria, through her higher education institutions, particularly the universities, wants to become a knowledge economy as well as a learning society. Becoming a successful knowledge economy is intertwined with the ability to become a learning society. A precursor to both, however, is a quality assured- based higher education system, as well as sustainability for the university as an academic community.

Saint et al (2004)[2] had indicated that Nigeria was one of the many developing countries that "have neither articulated a development strategy linking knowledge to economic growth nor built up their capacity to do so". Talking of taking advantages of the use and utilization of Open Educational Resources, OER, it could equally be said that Nigeria is one of the developing countries that had not yet started to fully explore the advantages of this movement for the development of higher education . MOOCs is a newcomer to the online scene yet it is making a rapid and forceful entry into the scene. What opportunities are there for Nigeria if she wants to take advantage of the OER movement as well as the rapidly growing clientele of MOOCs, and what are the challenges that may be faced in appropriating those opportunities? This paper tries to answer the question.

Open Educational Resources

The application of technology to education and the adoption of e-learning platforms =is becoming increasingly prominent in tertiary education globally and Nigeria is not left out. However, most e-learning platforms and learning management systems available for educators and students are for commercial purposes. Many others are under proprietary systems. Many others still are under copyright. The implications of these restrictions are many, including among others: to use commercial materials you have to pay or subscribe to them; to use proprietary materials you need to obtain passwords to uncode or unlock them; and to use copyrighted materials you need to obtain express permission from the authors. Combined together, these dictate that although the materials are available on the web, they are not free, hence not every one can access or even use them. However, when Wayne Hodgins came up with the term, "learning objects" in 1994, little did any one know that he was starting a revolution in education -- as educators, instructional designers and others quickly picked up the term. Soon, the idea arose that digital materials could be so designed to make it easily re-usable in a number of teaching and learning situations. Soon after this, in 1998, David Wiley introduced another term, "open content," which almost immediately became popular amongst internet users because of its importance and relevance in the introduction of the open publication license which was further improved upon with the introduction of the Creative Commons, CC.

This was followed almost immediately the same year, 2001, by the MIT OpenCourseWare, OCW, initiative, when MIT decided to put virtually all its courses for free public access *and* for noncommercial use.

All these developments between 1994 and 2001 impacted in various ways on the emergence of Open Educational Resources, OER, and in fact set the stage for a rapid expansion and ready acceptance of the OER movement.

These developments fascinated the UNESCO, which in 2002, held a global forum comprising those of like-mind with the desire to jointly develop "a universal educational resource available for the whole of humanity." They chose the term "open educational resource" to describe their efforts and defined it as:

Open Educational Resources are defined as "technology-enabled, open provision of educational resources for consultation, use and adaptation by a community of users for non-commercial purposes". They are typically made freely available over the Web or the Internet. Their principal use is by teachers and educational institutions to support course development, but they can also be used directly by students. Open Educational Resources include learning objects such as lecture material, references and readings, simulations, experiments and demonstrations, as well as syllabi, curricula and teachers' guides. (see Wiley, 2006;[3] D'Antoni & Savage, 2009[4])

Open Educational Resources (OER) are digital materials that can be re-used or re-purpose for teaching, learning, and research. They are made available free through open licenses. OER include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge. is one of the growing movements in education.

OER Practice in Nigerian universities.

In a three -day workshop hosted by RETRIDAL with support from COL at the National Open University of Nigeria in November 2012, the 30 participants drawn from about 10 universities including the National Open University of Nigeria, responded to a Questionnaire on OER. (see Ipaye, 2012) [5] Their responses, which formed the focus of another paper, indicated that less than 10% of the respondents had ever heard of OER. All participants indicated that there were no official references to OER in their universities, there was no OER policy and no funding was provided for the development of OER. This revelation about the current status of OER in Nigerian universities may be shocking, yet it could be said that 10 out of 128 may be too small a sample size. This not withstanding, two Nigerian universities, University of Ibadan and University of Jos, were listed on the OER Africa website as members of the Partnership for Higher Education in Africa Education Technology initiative (PHEA ETI). It was in fact indicated that there had been some workshops on OER at the university of Ibadan in September 2010 run by SAIDE, the initiator of OER Africa.
The finding however supported the finding by Okonkwo (2012) [6] who, in a study to assess “the needs, readiness, and willingness of ODL professionals from two dual-mode universities in Nigeria to deploy OER in teaching and learning” found that “educators have not really embedded OER in teaching and learning, but they are very eager to be trained in the rudiments of OER and wish to employ them thereafter”. Both studies, Okonkwo’s (2012) and Ipaye (2012) were clear indications that Nigerian universities do not yet know much about OER and thus the opportunities that could accrue from its use.

How can Nigerian universities benefit by harnessing OER?

There has been the dire need to improve the quality of education and make university education more effective and efficient in Nigeria. The OER community has argued that OER has the potential to contribute to improving the quality and effectiveness of education. Also, as a web-based material, and with the current role of ICT in education globally, OER is most likely to help tackle the problem of access to higher education.
One of the ways of improving quality and effectiveness of education is development of quality teaching and learning materials, thus leading to the provision of an improved academic environment, which will in turn contribute to more productive staff and students. The current teaching style in the universities is mostly that of a sage on the stage whereas with the use of OER, students could become active participants in educational processes, thus boosting their learning by doing and creating, rather than passively reading and absorbing. According to COL, (2011) [7] “Content licenses that encourage activity and creation by students through re-use and adaptation of that content can make a significant contribution to creating more effective learning environments”. OER could also help in the development of capacity of academic staff in study materials

development, course design, and research, thus helping them to acquire the habit of collaboration and building on common intellectual capital, rather than duplicating similar efforts". While it has been argued that the effectiveness of OER depends on the procedures put in place by the institution, it has equally been suggested that OER can transform the educational system and practices by:

1. Improving the quality of learning materials through peer review processes;
2. Reaping the benefits of contextualization, personalization and localization;
3. Emphasizing openness and quality improvement;
4. Building capacity for the creation and use of OER as part of the professional development of academic staff;
5. Serving the needs of particular student populations such as those with special needs;
6. Optimizing the deployment of institutional staff and budgets;
7. Serving students in local languages;
8. Involving students in the selection and adaptation of OER in order to engage them more actively in the learning process; and
9. Using locally developed materials with due acknowledgement.

The transformative potential of OER also includes the benefits of sharing and collaborating among institutions and countries, and the creatively disruptive role of OER in opening up new educational models.
(see COL, 2011, [7] Kanwar and Uvalić-Trumbic, 2011, [8])

Opportunities for Nigerian universities:

The OER literature contains myriad opportunities and potentials afforded by the OER movement for different stake holders - both for the conventional face-to-face teaching and learning situation and for those involved in distance education, including open and distance learning. (OECD, 2007; [9],

For Nigeria, we shall mention just a few without discussing them in any details.
The OER movement can help Nigerian universities and other higher education institutions keep up with most recent developments and practices in HE globally, especially since globalization and technology will continue to shape the growth and development of education across the world in the foreseeable future.(OECD, 2007).[9] Nigerian universities need to bite into this.

For both teachers and learners, and other stakeholders, OER will help make educational resources more available and accessible. Nigeria already has an IT policy but she needs to link OER to this for the advantage of her universities and HEIs. Many of the private universities recently licensed are finding it difficult to build and equip robust libraries as well as acquire learning resources. The various approaches by the OER-movement - like the MIT-OCW and others - could be used to support teaching and learning activities in our HEIs especially where there is reported shortage of academic staff.
A recent report by a 10 man committee set up by the Federal Government indicated as of November 2012 that a

"study of 61 universities out of the existing entire 74 public universities in the country unequivocally determined that there is a shortage of lecturers with Ph.Ds, as only 43 per cent of lecturers nationwide hold the qualification, instead of the expected 100 per cent". (*Wale Shokunbi, The Sun Newspaper, November 12, 2012*). OER may stand in the gap. OER can also get Nigerian universities to appreciate more the value of collaboration, resource sharing, redistribution and re-mixing.
OER could help in improving the research abilities and capacities as well as increasing the research output of Nigerian academics. A Government Task Force found that in 1995, Nigeria's number of scientific publications was 711 – significantly less than its output of 1,062 scientific publications in 1981 by a comparatively much smaller university system (TASK FORCE 2000).[12]. In contrast, scientific publications were 3,413 for South Africa, 14,883 for India, 310 for Indonesia, and 5,440 for Brazil (TASK FORCE 2000). The country's low research output probably reflects the low priority accorded to research and development, not only by government decision-makers, but also by university administrators. For example, Nigeria's federal university system spends only 1.3% of its budget on research (HARTNETT 2000) [13]. OER is likely to change this trend for better

We can link these with aspects of the definition of OER. To fully comprehend our discussions of the opportunities available for the use of OER in a country like Nigeria, we need to further look at Downe's explanations of the definition of OER. Downe (2008) [14] argued that 'access' is the most important component of the definition of OER because " Fundamental to a resource being open, … is the ability of anyone to access it...". "Use" is equally important because we need to be able to use the resource; we need also to be able to 'modify' and 'remix' the resource and then the freedom "to share copies of the original content, your revisions, or your remixes with others."
The opportunity to 'access', 'use', 'modify' and 'share' is quite an immense one. For access and to access, OERs are typically stored in databases, or repositories. Each institution that creates OERs usually also stores their materials in their own database, sometimes called a "learning object repository". Making OERs accessible to indexing engines like the COL Knowledge Finder, …is critical to enabling educators to quickly find and download resources. *(Karen Speirs,* 2006).
The purpose of the word 'freely' in the definition is intended to stipulate that the resource may be accessed without conditions. This, by the definition, means without payment. (Downe, 2008)

For use and to use, OER is available to 'anybody', and as Downe (2008) argued, "Though typically omitted from accounts of OERs, the reference to 'anybody' is important. "Anybody'" here refers not only to education providers, not only to teachers, not only to enrolled students, but to *anybody*, the entire population of humans". D'Antoni and Savage, (2009) had added the point that "OER is in fact the nexus of a range of efforts that address the need to 'unlock knowledge' and open access to knowledge for all".

For both access and use, "Computers, bandwidth, tools and implementation resources are critical to this development because they allow open content to be accessed and used. For example, teachers have to be able to search for potentially useful resources, and these

resources need to be in formats that enable them to be adapted and reused. The Creative Commons license … makes resources legally available for adaptation and reuse.
(*Speirs,* 2006)

Nigerian universities, like all others globally have the opportunity to modify OER materials, remix, re-use and adapt for their lectures, research and other academic purposes. Equally important is the opportunity to share both among themselves, as well as with their students who through OER, can have free access to courses from some of the world's best universities. OER can also offer students huge cost savings as alternatives to expensive 'handouts' and textbooks.

To further appropriate these opportunities, Nigerian universities should take a deeper look at the suggestion by COL(COL, 2011, Kanwar and Uvalić-Trumbic, 2011) on the need for institutions to make some policy reviews. These reviews pertain to setting clear policies on intellectual property rights, IPR, "policy guidelines regarding whether or not the creation of certain kinds of work (e.g. learning resources) constitutes part of the job description for staff and what the implications are for development, performance management, remuneration, and promotion purposes"; enabling the staff access to and use of the internet and required technologies; and guidelines for development, selection, as well as copyright clearance of their work. The policy must also contain clear guidelines and steps for rewarding staff involved in creation and development of OER. Equally interesting but important are the guidelines suggested in the same document (COL, 2011).

Challenges to the development and use of OER in Nigerian universities.

For most universities in developing nations especially Nigeria, the introduction of OER and related technological practices creates a number of challenges. These challenges are attitudinal, technological, financial, pedagogical , advocacy and cultural.

Attitudinally, it is obvious that many Nigerian academics would want to know more about OER before launching out to embrace it. Lack of awareness of OER by Nigerian academics, therefore, could be a major challenge. There is the issue of ignorance, - Ignorance of OER by many Professors and young academics, and yet the unwillingness of many of the elderly Professors, (60 and above) to want to learn . It is difficult getting the elderly Professors to develop a mindset towards the application and adoption of OER, though interestingly, many of them are willing to submit their publications and academic work to be used as OER. In fact there was the case of an old Science Professor who was wiling to get the publishers of his work to relinquish the copyright so they could in for OER.

Technological challenges could be in various forms. There are those who lack digital literacy, there is the huge degree of digital divide within the university system, there is the group who do not have or can not own computers and laptops. Related to this is the issue of those who lack OER skills for the production and use of OER and those who because of digital illiteracy could not search for OER on the web. Further, there is a general ICT infrastructural problem in the country. The cost of computers is still high, there are broadband issues and the non-availability of internet connectivity. Though many universities are making efforts to provide Professors with computers and laptops, yet the problem of connectivity may persist longer than we can see. Electrical power is a major problem in Nigeria and this has implications for technology use.

Financial challenges relate to the inability to source funds for the production of OER materials. Universities in Nigeria have not started funding the production of OER and academic staff said they are not rich enough to raise personal funds for such exercise. No Nigerian university as of now has an official policy on OER and the Research committees of many of our universities do not know about OER, let alone allotting funds for research in that area.

Pedagogical challenges relate to the unwillingness of Professors and young academics to use OER. This is understandable since many of them do not know about OER. No academic staff claimed to be researching on OER, none claimed to have referred his or her student to any OER material

Cultural challenges relate to the culture of teaching and learning in Nigerian universities. Lecturers in most cases dictate their lecture notes which the student often than not memorize. In many universities, a rather sad development in the last two decades or so is the problem of "handouts". The dearth, scarcity and high cost of text books experienced in the country has led to the emergence of "handouts", i.e. the summarized or condensed form of the lecturer's lecture notes collated in print form and compulsorily sold to all students registered for the course. This had taken the place of textbooks to the extent that if a student claimed to have a textbook for the course, the lecturer will still expect the student to buy the 'handout'.

Advocacy is a challenge in the sense that few universities if any are providing information, training and exposure to OER. But more important is the role of the regulatory body and government in providing advocacy. The National Universities Commission, NUC, for example is at the verge of organizing workshops on OER for staff of Federal universities and dual-mode universities. (Ramon-Yusuf, personal telephone discussions, February, 2013). The problem of ignorance apart, there is also a general lack of deeper understanding as to what the real advantages and potential of OER can contribute to teaching and learning in the university and in fact to the whole higher educational eco-system.

Massive Open Online Courses (MOOCs).

MOOCs is the acronym used to describe "Massive Open Online Courses." It came onboard the on-line learning hemisphere in 2012 (see Daniel, 2012 [16] and since then it had been making waves as many people, university teachers, students, and even people far removed from the actual work of teaching or learning at the university have developed some obsession for it.

Massive open online courses are attempts to create open-access online courses that provide no constraints on class size. They run over a defined period of time, are self-managed by groups of learners and teachers, there are no formal entry requirements. MOOCs are open to all, and some offerings take the form of free courses based on existing university teaching materials freely available online, with computer marked assessment and certificates of completion. MOOCs has no regard for class size as some courses have engaged over one hundred thousand participants. MOOCs can be purely informal offerings, or opportunities for independent learning aligned to a formal course, or semi-formal courses offered by an institution for informal certification. (see Sharples et al, 2012) [17]

Writing in the February 18, 2013 edition of the *Online Colleges, Open Academic*, Rooney [18] said,

> "The big news in online higher education last week was the American Council on Education (ACE) announcement that five massive open online courses (MOOCs) offered by Coursera should be accepted for credit by colleges and universities. The courses were created by Duke University, the University of California at Irvine and the University of Pennsylvania; all are basic or introductory courses in math and science". (http://www.onlinecolleges.net/2013/02/18/the-pros-and-cons-of-moocs-for-credit/)

The point here is that MOOCs are rapidly becoming a force within education, and no country can afford to be left out in appropriating the benefits. Supporters of virtual learning argue that it is the wave of the future, destined to broaden access to higher education for millions of people across the world. They point out some specific benefits:

- **Unlike many education reforms aimed at reducing costs for students, MOOCs really do lower costs.** They are generally "free" in the sense that students do not need to pay Coursera or the other big MOOC providers to take the course. However, if a student needs to prove course completion, for example for employment, they need to pay for a certificate of completion. Now that ACE has deemed certain courses credit-worthy, students can also take a fee-based proctored exam that will allow them to transfer the Coursera credits to any colleges and universities that will accept MOOC credits.
- **Quality has improved.** In terms of quality, it was observed that the approved courses are created by thoroughly qualified scholars. She spoke with the director of open-course initiatives at the University of Pennsylvania about his faculty, and he said of one professor's course, "Once [Ghrist has] prepared a Coursera course, he doesn't go back to teaching calculus the same way." A student named Amy confirmed this in a comment on *The New York Times* "The Choice" blog that in

> one course she took “the science was not dumbed down. The instructor clearly loves teaching, and the class was fascinating. I found the material challenging (and I have a BS in chemistry) and the class engaging. I got more out of it than some of my classes at brick-and-mortar schools.” (see Landry, 2012) [19]

Opportunties for Nigerian universities to use MOOCs

Though all Nigerian university students could be said to be internet migrants today, and in spite of the various technological challenges, Nigerian university students are becoming much more familiar and at home with technology and the computer. There is virtually no university student without a cell phone, and the majority of them have cell phone that can browse. Also, many have laptops. Nigerian university teachers therefore need to stop seeing students interacting with the computer and using the internet as a threat, but try to turn such a behaviour into an asset. This could be done by assigning their students online course work, introducing them to MOOCs, getting them to share information online, getting them to do collaborative reading and work on MOOCs, helping them identify relevant MOOCs which they can use to enhance their class work. Credit transfer between universities in Nigeria is not yet standard practice, but students can gain from MOOCs while completing their assignments and projects etc. Professors and young academics too can benefit from browsing through some MOOCs and using materials there to improve their lectures and course delivery.

Conclusions:

The view expressed in this paper is that Nigerian universities have lots of opportunities to apprise, use and even join in the creation of OER materials and that both staff and students can benefit from the rapidly developing system of MOOCs. Though we mentioned a few challenges, we could not go into the discussions of how to tackle those challenges. It is worth mentioning however that there is need for lots of capacity development in the creation and use of OER and there is also need for copious advocacy in the use of both OER and MOOCs. MOOCs with its no class-size limits may in fact be one of the ways to go in handling large classes in Nigerian universities.

Ipaye (2012) had suggested a number of things that could be done to promote OER and in fact MOOCs in Nigerian universities. He referred to them as “the future of OER in Nigeria”. Some of his suggestions are briefly mentioned below.

•Publicity, Awareness and Advocacy: He suggested the need for an aggressive publicity and advocacy to create awareness of OER amongst universities and their academic staff.

•Using OER: Staff should be encouraged to use OER both in the development of lecture notes, in teaching and in their research. They should also be encouraged to refer their students to OER materials as further resource materials.

Training: to be able to use OER and get their students to do so, academic staff need to be trained on how to create OER materials, hw to find OER materials and how to use OER generally.

- Research : OER could be a very useful research source for staff and students especially in the areas of literature review, methodology adopted by earlier researches on the topic and in fact the aspects of analysis
- Getting colleagues to use: Academic staff who already know about and can use OER should be encouraged to motivate their colleagues to do so and in fact help to train their colleagues
- Getting our students to use: Once staff know about and can use OER, they should be encouraged to get their students to find, use and adopt OER materials. Further, they should encourage and motivate their student to submit their assignments, projects etc for OER uploading in the university's database or website.
- Motivation and incentives: Universities should motivate staff to develop interest in the use and creation of OER by providing some incentives either in terms of funding such work or crediting such work based on agreed parameter, to the promotion of staff.
- Institutional policy: there is need for universities to develop policies on OER spelling out the benefits and procedures etc. Further, universities should spell out what is accepted practice in terms of using MOOCs. Since credit transfer is not yet a popular practice among Nigerian universities, policy on MOOCs may for a start just allow staff and student to use such materials to further boost their study materials and resources for further reading.
- Getting Regulatory bodies interested: Regulatory bodies of HEIs in Nigeria should develop keen interest in OER as well as in MOOCs and device means of motivating universities and other HEIs to know more about and be willing to use and contribute to OER. A simple policy pronouncement from the regualatory bodies would go a long way in motivating universities and other HEIs to advert interest in that direction.
- Finally, he suggested that steps in promoting OER in individual universities could include creating OER group among staff and students, establishing OER movement cells, raising OER research groups and university management including OER as part of funded research.

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Technology, Education and Emerging Economies

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ABSTRACT: *Technology has brought innovation in educational practices globally .India has not remained untouched by technological development .This paper will focus on how India as an emerging economy deals with blending age old problems of a nation with teeming millions who need education with balancing of equality with excellence. Even in these circumstances academics have tried to bring innovation in educational practices to make education an enriching experience for the learner.*

Technology in education is not a novel concept. Since there have been teachers and pupils there have instructional tools to enhance the teaching learning process. The tools have ranged from slates, abacus, blackboards, pens and pencils, typewriters, overhead projectors, computers finally the internet, mobile phones and social networks. Technology is a powerful enabling tool which caters to educational change and reform. If used appropriately and discerningly, different types of technology helps in enhancing access to education and its quality, while making teaching and learning an interesting and interactive process. There has been an accelerated growth in innovation in teaching tools, yet the classroom challenges remain essentially the same _

- How do we communicate with our students?
- How can we challenge and motivate them to think for themselves?
- How can we use the tools at our disposal to enrich the classroom experience?

There is little doubt that new technologies open up possibilities unheard of previously. But these technologies will have a limited impact if the pedagogy behind their application is not appropriate. Technology is nothing without a teacher who has planned a lesson where technology has been woven intricately and seamlessly. Moreover with the advent of the Learner Centred Classroom, which places each learner at the heart of the classroom transaction, technological assistance will give the much needed fillip to the learners' endeavours. No two learners are alike. Each learner brings a unique mix of learning styles to the classroom. It is a huge challenge for the teacher to identify these learning styles and design activities which appeal to the class as a whole and yet take the individual needs of the learners into account. Technology is indeed a powerful tool that can be used to differentiate learner needs and address them individually. We can see a strong correlation between learning styles and technology options. For example:

- For learners who are logical thinkers tools like excel spread sheet, online polls and surveys are appealing
- Those who are visual learners would enjoy working with digital cameras, video, and online resources such as Google earth
- Learners with a strong reflective side will feel comfortable blogging or building e-portfolios
- Even very physical learners have technology based options such as 3D worlds, virtual tours and animations

The intervention of technology has changed our outlook towards the whole teaching

The Indian Context _ Narratives for the future

If we survey the world around us it is evident that we are living in a watershed moment in the context of education. The biggest question that confronts us is "What do today's learners need in order to be prepared for the society of the future?" Schools have to prepare learners for rapid change, the routine skills that were important at one point in History are no longer important. Schools have to become hubs of opportunities to foster ability to construct knowledge and creativity. Translation of this in practice means that teachers need to become catalysts, the key agents who can bring a new continuously evolving society into being. How would this mandate affect their role? As catalysts, teachers of a successful society need to:

- Promote deep cognitive learning
- Learn to teach in innovative ways
- Commit to continuous professional learning
- Build a capacity for change _ in themselves and the learning environment by trying out new ideas.
- Promote creativity
- Problem solving

The development of a robust state is always tied to education. The mode of education that has traditionally been in fashion since colonialism favours the privileged teacher entering a class comprising of generally underprivileged seekers. The teacher fulfils her duty by bestowing the light of learning on them. A knowledge society is characterised by continuous change in the socio – political context as well as in the expansion of information and knowledge. Citizens of such a society need to restructure their mind set to be compatible with this world. India finds itself at the threshold of such a change. It is essential that we study our nation from this point of view. As global technology advances swiftly, access to software and information is quicker and definitely cheaper. The revolution in technology will continue and so will the revolution in educational practices and the way we think about emerging nations.

The Indian economy over the last decade reads like a success story. After a major economic crisis in 1991 followed by bold reforms measures, the economy has experienced a rapid economic growth and foreign investments. At the same time there has been a boom in the information technology sector. Technology has seeped into the lives of the common man in India in many ways. From mobile technology, to learning software we can see its evidence in all walks of life. The changing trend in education demands technology friendly teaching but the country is still struggling with decade long problems, like out of school children, drop-outs, teachers' shortage, lack of infrastructure, balancing between equality and excellence, common standard curriculum. This coupled with crushing poverty, social and political inequity, the rural and urban divide has resulted in a vast chasm between the have and have not's in terms of access to educational and professional opportunities etc. In such a scenario, it becomes highly challenging to even define minimum education criteria to meet the dream goal of Universalization of Education. In spite of all such challenges, the Government and academia have joined hands to bring innovation in educational practices to make school education a worthy experience for the child.

In India the Right to Education Act came into effect in the year 2010. This act makes education a fundamental right for every child between the age of 6 to 14 years. It's the first legislation of its kind in the world to puts the responsibility of ensuring enrolment, attendance on the government. But at the same time the quality of education provided by the government remains a debatable issue. These problems are further accentuated by student and teacher absenteeism as well as mismanagement of funds and teacher appointments, a general malaise that afflicts Indian society as a whole. Children attending private schools are seen to be at a distinct advantage over their government school educated brethren, in terms of availability of appropriate infrastructure, latest teaching – learning resources, able and committed teachers and a conducive learning environment. These schools are attended by the children of economically and educationally privileged parents, who have the necessary monetary wherewithal to pay the exorbitant fees.

It is evident that there is a vast disparity in the Indian classrooms. On one hand we have classrooms equipped with state of art infrastructure in terms of a Smart board, computers for each student or at least access to computers in the computer laboratory, online submission of assignments, creating wiki, blogs as a conduit for learning. On the other hand there are packed classrooms with not enough space to seat the learners comfortably, let alone resources in the form of textbooks or technological intervention. This is a problem not only for the government but for all the teacher training institutions. How do we train our interns to teach in these disparate conditions? It is essential to redraft teaching strategies for different teaching contexts. The system of imparting quality education and training teachers to do it in diametrically opposed conditions needs to be revisited. The new vistas of knowledge and technology need to be integrated effectively while enhancing teacher competencies. Only then the evolving role of the teacher can be infused with a rigour that is the key to effective teaching.

The two faces of India: Cases from the field

We have been teaching the pedagogy of English and Mathematics (our examples will be mainly from these two disciplines) in teacher training programs run by the University of Delhi in New Delhi, the capital of India. Yet our pre service programs(under the aegis of the

Meta university concept or B.Ed./ B. El Ed) has to foster teaching competencies for varied and more importantly diverse needs. Interns need to be prepared to implement a new approach towards teaching.

Case study I

Any reform in education cannot make success unless we prepare our teachers to implement it effectively. The University of Delhi and Jamia Millia Islamia has initiated a remarkable step in this direction by introducing Masters of Mathematics Education under the concept of Meta University. The course itself is a unique venture in the field of education and technology because for the first time in the history of India, full-fledged course is being designed to dilute institutional boundaries by investing faith in technology. This unique course is a combination of teaching mathematics through technology based medium. The course incorporates multimedia tools in mathematics concept development. Though the course is only semester old but prospective teachers are getting wholesome experience in teaching of mathematics through technology.

The course has in-built vision of mathematics through technology. It heavily relies on the use of software such as, Geo-gebra, Mathemtica, Matlab and Graph Cal. The prospective teachers are taught different school mathematics concepts using these software's. The students are encouraged to solve challenging real life problems peculiar to Indian Context by developing mathematical models using technology. The use of multi-media is also stressed upon. Students are learning to develop movie-based mathematics lesson plans that bring child's local context in mathematics classrooms.

Case Study II

The Preparation of teacher trainees or interns begins during the early stages of the training program, in the pedagogy class as well as the visual education module. Both the modules transact the course work in three phases_ The preparation, followed by on the field exposure and finally presentations and discussions with facilitators and peers regarding the planning of classroom practices their integration with technology and feasibility and effectiveness of such activities.

An example from the field, that is significant, is of using films as a pedagogical tool. One of the schools that was part of our School Experience Program of our teacher training program (wherein our students move to the field for forty days and translate theory into practice) was equipped with the latest technological aids to enhance the teaching learning process. Most of teaching was done using Smart Board in addition to the prescribed textbooks.

Shakespeare in the Indian Context

In a language class (class xi) students were initiated into the the intricate world of Shakespeare. It is a trial by fire in the most mundane of circumstances but in India it presents a major challenge_ since we are dealing with a multilingual classroom where learners are competent (in varying degrees) in English as a second language. Most of the learners were acquainted with Mark Antony's speech from Julius Caeser from their course book in class tenth. In class eleven, the learners were exposed to speech of Macbeth_ " canst thou not…." a speech of great psychological import that requires deep reflection and analysis. One of our interns used screening of the film based on the play as a pedagogical tool for teaching. This was an important strategy that had been discussed in the pedagogy class as well as the visual education module, both working in tandem to create effective teaching plans , and acting as major scaffoldings for the interns in their journey into the field. One of the films was directed by Roman Polanski and the other was a Hindi adaptation by Vishal Bhardwaj(an Indian filmmaker). A movie screening for teaching literature is not a novel idea by any chance (in the Indian classroom it is often looked upon with quiet disdain). Yet it created a world of difference in an Indian classroom of students who were familiar with British culture and had made forays into Shakespeare, albeit unwilling ones. Polanski's adaptation of Macbeth is a psychological study of greed, ambition leading to tragedy and guilt. While Bhardwaj' Maqbool reworks Shakespeare' classic through the medium of Urdu in the context of Mumbai' underworld, it remains faithful to Shakespeare' essential vision. The rendering of a classical text through the medium of film in English and Hindi helps in removing the alien aspect of the classic. With the scaffolding provided by the movie genre the teachers' clichéd textual explanations are replaced by reading the text through a visual medium. The literature classroom becomes extremely engaging and interactive, while the ideological and cultural gaps are smoothened in the discourse. The conflict of Shakespearean characters caught in the grips of their own emotions, racial prejudices and societal mores is better comprehended when their adaptation in Hindi films takes up problematic issues of class, caste and gender of today's times, since this is a world they are familiar with, a world that they live in. Film and literary text interface created an ease in transacting the text with its unfamiliar idiom and syntax. The class was then divided in groups of four and discussions on the theme_ Comparing Bhardwaj' interpretation of Maqbools' tragedy as that of passion as compared to Shakespeare's' tragedy of greed and ambition. This interface naturally resulted in a discussion on how radical is the transformation of the tragedy and does it add to the understanding of the character and his tragic downfall. Another group compared the written text with its film adaptation, while the third group discussed the geographical and mythical context of the play, with the witches, and how it adds to it's dramatic content. The ICT enabled rendering of a literary text is carefully woven by the intern to enhance the learner's critical thinking and collaborative learning. The module which gives the interns space to work with technology within the confines of a prescribed syllabus also opens their minds to the possibility of eliminating rote learning and creating room for critical and imaginative discourse between teacher and the learners.

The visual education module of the teacher training program exposes the interns to the possibility of creating an ICT enabled classroom. Their post field classroom interactions and discussions gives them greater clarity regarding the feasibility of such strategies. This is essential in today's world where most people show a high degree of compatibility with information communication systems like computers, internet, mobile phones, i-pads etc. Interns and learners alike experience heightened interest in the teaching learning process when they find that the classroom learning activity simulates the world of gadgetry to which they are accustomed.

The Smart Board is also very effective in teaching language by means of authentic texts and analysing authentic texts by means of language. This makes gra in it's adaptammar less boring as students can see a clear purpose and appreciate its value. In another classroom our intern taught a poem (Gabeba Baderoon "Art in Life- Life in Art"). The intern wrote the poem on the board. After having listened and read the poem they were asked to underline the verbs and verb tenses. The students could see that the poem could be divided into present, past, present, a journey, which is integral in the understanding the poem.

Case Study III

The first two case studies have described how our interns are exposed to ICT in the visual education module of their training program and how they weave technology with the teaching of a prescribed text. On the other hand this module also prepares them to use basic technology to pique the interest of learners who are studying in schools with not even the minimum infrastructure and are also many a time first generation learners. Sugata Mitra (TED) of iconic "hole in the wall" experiment has worked in the same circumstances . His experiment brought to light several startling results. The experiments carried out in the slums of Delhi (the capital of India), and the deserts of Rajasthan showed how a child's innate curiosity is enough to move up the ladder of learning.

In India, as in other emerging economies, we do not only have to provide education to teeming millions but at the same time have to contend with stark realities of lack of infrastructure, power outages lasting for days as well as lack of internet facility. These harsh ground realities have made us find alternatives. Our interns have used a single computer coupled with hand- made visual aids to teach simple English lessons to learners coming from backgrounds where English is not a seen as a second or foreign language but actually an alien tongue. This actually adds to its exclusive status and social prestige.

Studies have been conducted in India that show that mobile phone networks are prolific and have access in the remotest corners of India's vast terrain. In such a social context the usefulness of mobile phones cannot be scoffed at. Its portable and affordable also it is essential to understand the relative advantage of this technology, to know its compatibility with current classroom practices. Some of the ways it can be used are:

- Electronic Dictionaries
- Mobile games : Learners can access online word games through web browser
- Learning and practice of English through sms (Short message Service).

Everyone from a humble farmer, plumber has a GSM mobile phone. It's a portable instrument that can be used for small business or just social networking. Everyone is therefore texting. So even in classrooms in poorly funded schools every student is texting his friends etc. It appeared to be a menace that could not be controlled even through corporal punishment. So when you cannot beat them join them. The solution which we as teacher educators found as viable was to make text messaging a part of the English learning process. Our interns gave the students in their class opportunity to text each other in class, read the text (teacher approved) and grade them on the accuracy of their spelling and syntax. The practice of sentences of 140 characters or less were easier to handle for speakers of English as a second language. This was not a replacement of formal textual learning but it provided space to students to practice using English that was fun and easy. Mobile technology provided a free tool to enhance learning experience in a sustainable and enjoyable way. Instead of writing informal letters our interns have used the sms as means of note taking, note making and communication. The mobile phone is generally possessed by most learners therefore it is an important aid in language learning. Our interns have also used the recorder present in mobiles to record songs, poems and dialogues for listening by the whole class and in groups. In the classroom context the interns have recorded dialogues made by students in pairs or groups and then replayed them. This gives the learners opportunities to hear what has been recorded and give feedback regarding the relevance of what they have heard and try and fill the gaps with what they find lacking. This is a practical use of authentic material to foster language skills at the elementary school level.

The cases discussed above show how teachers have to be can be prepared to deal with disparate classroom expectations. The post field discussions are the most enlightening and give deep insight into the basic fact that fascination with technology at the expense of sound pedagogy is not the road to be followed. Technology has great potential but we must accept the ground reality that there is still a huge divide between teaching strategies of the analogue classroom of the emerging economies and the digital world that beckons us so provocatively. As teacher educators we have to work with both type of classrooms and make learning as enriching as possible_ for the learner, intern and ourselves, the teacher educators.

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The Realities of Operating an Open University in Sub-Saharan Africa

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Abstract

This paper discusses how Open University of Tanzania uses technology to lower barrier to education and jobs for Tanzanians. Majority of public institutions, higher learning is no exception, depends on government subsidies for its existence. In recent years there has been a major shortfall in government funding, especially in higher education. OUT being one of the more prominent higher education institutions in the country, it has to devise a more creative way to sustain and maintain the programs that serve the educational sector despite the challenges it is faces along the way, which includes partnership with domestic and international institutions and with non-profit and for-profit organizations.

1. Introduction

The Open University of Tanzania (OUT) was established by an Act of Parliament No.17 of 1992. It is the first university in the country to offer its educational programs through open and distance learning mode. Eleven years later, by March 2011 the university has expanded to 29 regional centers in Tanzania. These regional centers are envisioned to be regional colleges, and coordinating centers in the nearby countries of Kenya, Uganda, and Rwanda, as shown in Figure 1. It is currently ranked as number three institution in Tanzania [5].

Figure 1: OUT regional and coordination Centers

As a pioneering institution of higher learning that models open and distance learning, OUT realizes the daunting task of implementing the program and consequently developed a Rolling Strategic (RS) plan that unleashed a momentum to formulate various policies, strategies, and operational procedures to assist to govern many of the key activities of the university, as a guide to help the university respond to the challenges such as establishing an e-learning department as an effective teaching and learning tool within and outside the university[1].

2. Challenges facing education and job programs at OUT

The main barriers to providing a good education at OUT have been funding resources and local expertise. Since its establishment in 1992 OUT has been largely dependent on government subsidies and donor funded projects in most of its operations. The funding has been reduced significantly recently, and in the near future, the funding may be stopped completely. Therefore, there to sustain its educational activities, OUT must seek alternative funding.

The educational model of open and distance learning has a heavy reliance on ICT infrastructure for its core functions. Therefore, the availability of facilities, equipment and skills become even more crucial to sustain OUT mission of providing access to education for the local community. Till present day, the institution has yet to acquire enough ICT facilities and equipment for access to its entire staff. Furthermore, some of its staff members are yet to develop the skillsets required to function in an ICT dominated academic environment. With inadequate funding in reservoir, OUT needed to come up with innovative ways to effectively address this shortfall of funding.

2.1. Reduction in government funding

Table 1 provides a twelve plus years of historical context of government funding to OUT. Here are some of the highlights [4]:

- Zero development funds have been given to OUT since 2010/11 academic year.
- Funds for "Other Charges" have fallen from TZS 1.14 billion per year in 2011-2012 to only 678 million in 2012-2013.
- Funds for Personal Emoluments include, and not limited to salaries and allowances.

Table 1. Government funding to Open University of Tanzania (2001 – 2013*)

unit in TZS million

Year	Other Charges	Personal Emoluments	Development	Total
2001-2002	1,104	605	200	1,909
2002-2003	983	913	80	1,976
2003-2004	1,163	1,296	50	2,509
2004-2005	1,090	1,090	50	2,230
2005-2006	1,490	1,540	100	3,130
2006-2007	1,304	3,999	692	5,995
2007-2008	1,017	4,759	500	6,276
2008-2009	1,017	4,735	1,041	6,793
2009-2010	1,017	6,390	2,241	9,648
2010-2011	1,017	8,920	-	9,937
2011-2012	1,141	10,055	-	11,196
2012-2013*	678	6,589	-	7,267

Note: * up to February, 2013.

2.2. Lack of local expertise

All of available information systems (SARIS and LMS), and website and email systems were outsourced to private companies, before 2008. Network installation and ICT hardware maintenance and repair were also done by private companies and the university was charged very high fee for the services. By 2009, all ICT consultancy and services including software development, ICT hardware maintenance, and network installation were done in-house by OUT ICT staff.

Due to low wages, retention of these skilled local ICT staff has been a challenge to OUT, especially in the area of supporting distance-learning students. OUT has introduced performance-based incentives to staff to supplement the low pay. To some extent, this approach has helped in retaining local experts, but appears to be a temporary, since cost of living kept increasing and OUT is not able to keep up with increasing the incentives or bonus to its staff.

3. Responses to the challenges to education and job programs at OUT

OUT has found creative ways to address the two major challenges in education - by tapping into government-funding projects, develop partnership with multi-stakeholder in the non-profit and for-profit organizations as well as domestic institutions. The self-help programs enables OUT to generate income such as providing technical and vocation online programs that engage with the local community in order to maintain a consistent relationship with the secondary schools - the future of its education population. In addition, OUT is leveraging its distance learning programs, Moodle, a Learning Management System (LMS) to tap into economic opportunities with industry sectors specifically the agricultural, entrepreneurs and tourism industries.

3.1. Government-funded projects

Projects funded purely by the government are rare and their statistics is difficult to establish. However, the Tanzanian government did provide subside to education in all levels at one point, albeit in a declining state in recent years. The main source of funding is from donor funded projects, which has a high risk in sustaining viability without donors' contributions such as Institutional Capacity Building Program (2007-2012) funded by Swedish International Development Agency (Sida); Science Technology and Higher Education Program (STHEP) funded by the World bank; and National Research and Education Network (NREN) funded by the World Bank to improve the ICT infrastructure and application services for better management of increasing number of students.

3.2. Partnership with multi-stakeholders in the non-profit and for-profit organization

OUT has been collaborating with local organization such as Tanzania Education and Research Network (TERNET), world-class organizations such as Internet2 and Network Startup Resource Center (NSRC) at University of Oregon, and with networking companies such as Cisco Systems and Google, in developing local experts, as part of human capacity building. This approach has also proved to be very successful, but require an ongoing funding support to ensure that trained staffs are retained and training facilities are maintained.

TERNET and Internet2 contribution to OUT : Through the assistance of OUT, TERNET signed a Memorandum Of Understanding (MOU) with Internet2, on June 2011, to jointly collaborate on the development of next-generation Internet technologies and applications [2]. The objective of Internet2 is to lead and coordinate advanced networking through applications development and network engineering, while TERNET objective is to facilitate cheaper access to national and international education and research information resources through a reliable network infrastructure. Internet2 and TERNET promote their respective objectives by providing for appropriate collaborations and interconnections among their member institutions.

NSR C and Cisco contribution to O U T: Similarly, Cisco had provided a week long training workshop called, Developing Local Talent through Technology (DLTT), focusing on the area of networking. DLTT program is delivered through collaboration with multiple organizations, see Figure 3. A total of forty hours of theory and hands-on lab sessions in the areas of voice, wireless, network security and soft skills development, are delivered to 100 to 150 students by a global team of Cisco engineers with subject matter expertise in their fields. These SMEs share their personal and professional perspectives in what it takes to overcome skillset barriers in order to build the competency and capacity of a talented workforce in the emerging market.

The impact of the DLTT workshop is tremendously successful given the high-quality content workshop, yet a low-cost option, to the host universities that participated in the program.

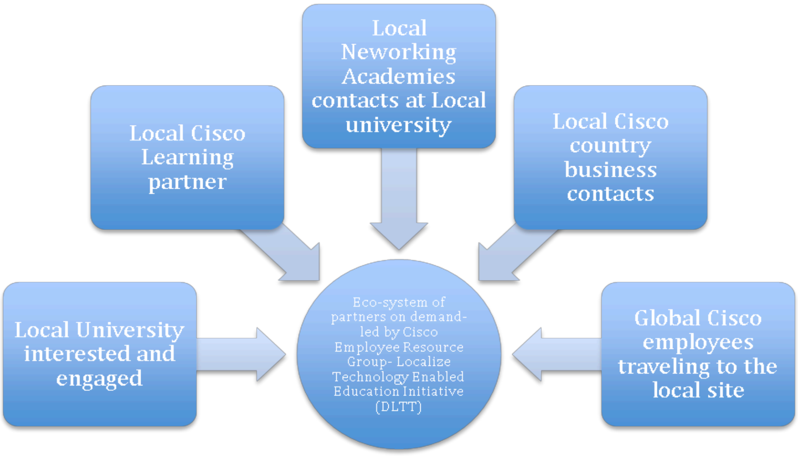

Figure 2: Cisco's low cost option model to provide a technical training program

This multi-stakeholder partnership model provides a solution to overcome the barrier of academics engaging industry experts and offer a valued learning opportunities for all parties who invest their time, effort, knowledge and funding in covering the cost of the workshop that can be evaluated to range between USD 2,000 to USD 2,500 per head. The total costs add up quickly to serve a 100 – 150 participants. Each stakeholder stands to gain and mutually benefit from the workshop either as a result of their contribution to the program.

Google contribution to O U T : Since 2009, OUT students mails are hosted by Google through their widely available education apps package. This has been a great contribution to OUT considering that its students are not residential; therefore emails form an important part of their day to day communication with their fellow students as well as the faculties. Due to lack of enough resources, OUT was not able to provide such important service to students prior to 2009. Figure 5 shows a snapshot of the email system portal

The RS plan includes providing quality training services to the public. To that end, OUT holds information sessions at its headquarter, as well as throughout Tanzania, by establishing community computer labs in ten regional centers, where citizens are trained on ICT skills in different levels, from basic, intermediate, advanced, to professional. See Table 3. These community computer labs allow citizens to be trained until midnight. The fees for the courses are reduced by half in order encourage attendance.

Underserved professionals, such as watchmen and petty traders with low income, have taken up the opportunity to attend these evening classes. In addition, other relevant short courses like "Entrepreneurship" are also offered on a seasonal basis. Despite the achievement in this area, there are challenges in the implementation due to shortage of staff and maintenance of training facilities.

Table 2: OUT students labs and ICT community skills Lab coverage

Region	OUT Students Lab	ICT Community Skills Lab
Kinondoni	1	1
Mbeya	1	1
Shinyanga	Nil	1
Mwanza	1	1
Iringa	1	1
Kilimanjaro	1	Nil
Arusha	1	Nil
Kigoma	1	1
Ruvuma	1	Nil
Mpanda	1	1
Singida	1	1
Tanga	1	Nil
Manyara	Nil	1
Temeke	1	Nil
Ilala	1	Nil
OUT HQ	1	2
Total	14	11

In bridging the gap between higher learning institutions and secondary schools, OUT has organized presentation sessions to students on the benefits of open and distance learning, In addition, basic and professional ICT training sessions offered during school breaks in order to give secondary students opportunity to enhance their ICT skills.

3.4. Economic opportunities

The use of information technology at OUT has facilitated the growth of income level to the local community, mainly by improving the level of their skills. Three initiatives have been developed in this area:

1. OUT and Sokoine University of Agriculture (SUA) under the project sponsored by Danish International Development Agency (DANIDA) have established the use of Moodle, which has been in used since 2006, and mobile phones to promote availability and accessibility of learning content for agricultural extension officers[1]. Figure 5 illustrates one of the agricultural courses being offered at OUT. http://elms.out.ac.tz

Figure 3. Courses in the Moodle LMS

These agricultural officers are working with the farmers in the poultry farming fields with heavy use of mobile applications [3].

2. OUT is also offering short courses on Entrepreneurship along with ICT skills to the local community to set up their own enterprise or company and to manage it successfully.

3. OUT is currently collaborating with North Carolina State University and Pennsylvania State University in a program called People-First Tourism (PFT) to bring more income benefit to individuals and groups involved in tourism industry. The program provides an internet-based marketplace portal. The program forges a direct

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[1] These officers are intermediaries between research and farmers. They operate as facilitators and communicators, helping farmers in their decision-making and ensuring that appropriate knowledge is implemented in order to obtain the best results.

connection between buyer and seller, thus, bypassing the middle tourist group brokers. The direct relationship inevitably has a positive economic impact on supplier of the local community.

The benefits provided by these initiatives to the local community are unquestionable. With exception of Entrepreneurship courses, the major challenges of the sustaining the initiatives is to reduce the rates being charged from telecom companies for mobile phones download. The university has to establish means of sustainability, and also negotiate educational pricing model so these initiatives can benefit the intended groups.

4. **Ultimate barrier to change: Tanzanians’** Mindset

To complement the technical training, OUT started a “culture transformation and team building” to its staff since September 2009. The impact brought by this training is yet to be measured. However, initial results are encouraging; the training had a positive impact to the forty staff that were trained. Currently it costs about USD 9,500 for training a group of 40 staff, With 700+ staff members, the cost could increase to USD 166,250 which is extremely expensive to OUT and remain to be the biggest obstacle to funding the training.

In general Tanzania has a big challenge in changing the mindset of its people. Figure 7 shows the dependency of these four building blocks, and the roles they play in operating higher education institution, in particular, open and distance learning institution in Tanzania. A huge effort is spent seeking funding sources to support purchasing new technology and the human resources to support the technology. However, the latter has been frequently outsourced to expatriates. The culture of dependency with foreign support for funding and skillset has to change. Till then, any improvement made in changing the technology infrastructure and developing the human capacity to support the system would be slow in coming.

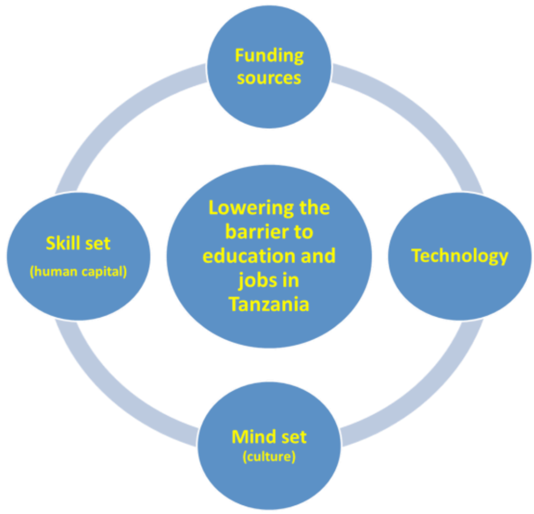

Figure 7. Building blocks to lowering the barriers in Tanzania

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Access to Internet Connectivity: the Major Bottleneck to the Adoption of Technology-Enabled Education (The Case of KNUST)

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Abstract

Every organization either corporate or a higher educational institution depends in part on its IT infrastructure to remain competitive and efficient. As this dependency grows, so does the need for providing effective systems to minimize downtime and improve efficiency of support provided. KNUST, is a public university in Ghana with a student population of 34438 and faculty numbering 801, hence a student-faculty ratio of 42:1 [1]. *KNUST desires to fully adopt a Technology-Enabled Education platform to supplement the traditional face-to-face session, but this is being impeded by the high cost of internet connectivity which is a critical requirement for e-Learning. This paper seeks to delve into the reasons for the high cost of internet connectivity in Ghana and its effects on the adoption of e-Learning platforms.*

1. Background

Based on research undertaken on IT help desk implementation in Kwame Nkrumah University of Science and Technology (KNUST), one main issue that users in the university call for support on was identified. This major issue is related to internet connectivity. This paper aims to delve more into the issue of internet connectivity and its impact on the adoption of technology-enabled education (TEE) such as e-Learning platforms.

1.1 E-Learning

Marfo & Okine in their research on the Implementation of e-Learning in Ghanaian Tertiary Institutions refers to e-Learning as the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance. E-learning can be used by lecturers to improve the efficiency and effectiveness of educational interventions in the face of social, scientific, and pedagogical challenges. E-Learning has gained popularity in the past decade; however, its use is highly variable among universities [2].

E-Learning has the potential to transform Ghanaian universities. It is increasingly gaining universal acceptance as a viable means of enabling large numbers of students to access education. Kwame Nkrumah University of Science and Technology, Ghana, realising the enormous potential of e-learning as against the university's ever increasing student population has chosen to adopt e-learning as a platform to transform how education is accessed. This desire is highly impeded by the high cost and unreliability of internet connectivity which is needed for any e-Learning adoption to be a success.

1.2 Access to Internet Connectivity

Access to information is the 'life-blood' of the world's knowledge economy, but it is scarcest where it is most needed – the developing nations of Africa which require low cost communications to accelerate their socio-economic development. Few schools, libraries, universities and research centers on the continent have some access to the Internet but its high cost makes it unsustainable as compared to North America and Europe. For those that can afford it, it is thousands of dollars higher than in the developed world such that some of Africa's most well-endowed centers of excellence have less bandwidth than a home broadband user in North America or Europe, and it must be shared amongst hundreds or even thousands of users [3]. Connectivity in Africa is poor, unreliable, scarce and very expensive. Where available, it is almost never dedicated and users have to contend with frequent service outages at very slow speed [4].

Contrary to more optimistic utopian conceptions, the ''digital divide'' tends to be widening. DiMaggio et al, define this as ''inequalities in access to the Internet, extent of use, knowledge of search strategies, quality of technical connections and social support, ability to evaluate the quality of information, and diversity of uses'' [5]. In other words, the gap rather than closing up, seems to be widening.

1.3 Statement of the problem

KNUST, is a public university in Ghana with a student population of 34438 and 801 faculty, hence a student-faculty ratio of 42:1 [1]. It desires to fully adopt a Technology-Enabled Education platform to supplement the traditional face-to-face session.

In this information age, every organization depends on an effective and affordable internet connection to remain competitive and relevant in its core responsibilities. KNUST until recently, had dedicated internet bandwidth of 45Mbps with a monthly charge of US $22,500.00, exclusive of taxes. With the emergence of other Internet Service Providers (ISP) in Ghana, the cost of internet has dropped marginally but it is still not affordable enough to meet the need of the 37850 users in KNUST [1]. This always leads to congestion on the gateway which negatively impacts on its effective use for teaching, learning and research. This is the major bottleneck to KNUST's inability to fully take advantage of the various technology-enabled education platforms available.

1.4 Objectives of the study

The objective of this paper is to look at the effect of access to Internet on the adoption of technology-enabled educational tools and also its effect on teaching, learning and research in the university and make recommendations.

2. Research Methodology

2.1 Data Collection

Primary data was obtained by interviews and questionnaires, and processed in models. A structured interview was conducted on ICT staff of KNUST to help figure out the current IT infrastructure and how support for them and the applications that run on them are handled. The interviews also sought to find out whether KNUST has the IT infrastructure to support technology-enabled education.

Secondly, interviews were conducted on KNUST faculty members to find if they used any technology-enabled solutions and if these solutions had any effect on their delivery. The interviews also found out the effect of software piracy on teaching and research. The methodology also includes review of literature on technology-enabled education and access to internet connectivity especially on the Africa continent.

3. Internet Connectivity

3.1 Why High Cost of Internet Connectivity?

There are two main types of Internet subscription in Ghana. A fixed monthly fee for fixed (wired) broadband subscription and mobile broadband subscription, which is based on the amount of data the consumer uses.

Vodafone Ghana Limited has monopoly on the fixed broadband as part of the acquisition of 70% of shares in Ghana Telecommunication Company for 900 million dollars by Vodafone International PLC on July 23, 2008 [6]. In addition to the fixed broadband is also the mobile broadband which has very competitive pricing. Due to Vodafone's monopoly over the fixed broadband, they rather focus on the lucrative mobile broadband connectivity. This makes Vodafone the only source to go to for fixed wired broadband and therefore uncompetitive in pricing. Vodafone has therefore curtailed, for the time being, at least, the expansion of fixed line broadband. Thus, this infrastructure is concentrated in the urban areas and access to telephones are limited to a few elite.

For consumers who are still on the fixed broadband, an unattractive data cap has been introduced. Table 3-1 shows the rates of fixed broadband internet in Ghana as deduced from Vodafone's current rates [7].

Table 3-1 Fixed Broadband Internet Rates in Ghana 2013

Monthly Internet Allowance	Monthly Cost in US $[1]
15 Gigabytes	US $33.44
25 Gigabytes	US $51.45
Unlimited for personal use	US $92.62
Unlimited for Office use	US $180.10

The average mobile broadband costs US $0.10 per megabyte. In the same light, like the fixed broadband internet rates, the mobile broadband has bundle plans, the cost of mobile broadband plans from the Mobile Network Operators (MNOs) in Ghana is shown in Table 3-2. While majority of Ghanaians tend to use mobile broadband to access the internet, provision is quite expensive for the average person, as shown in Table 3-2 and as such, most of these users tend to be at least in the middle or upper-class. However, distance learning via the e-learning platform was supposedly meant to target those in the rural areas but has now become a privilege since only the middle or upper class can afford it.

Table 3-2 Some of the mobile broadband internet rates by some MNOs in Ghana

Mobile Network Operators	Monthly Internet Allowance	Monthly Cost in US $
Vodafone[2]	2.5 Gigabytes	US $15.43
MTN[3]	2.5 Gigabytes	US $20.58
tiGO[4]	3.0 Gigabytes	US $11.57

Until 2010, Ghana's biggest source of Internet bandwidth (shared with almost every West African country) has been the single submarine fiber-optic cable (called SAT-3) currently

[1] All Currency Conversions by Oanda. http://www.oanda.com/currency/converter. Accessed on March 16, 2013
[2] Source. http://goo.gl/zUNZe by Vodafone Ghana and accessed on March 1, 2013
[3] Source: http://www.mtn.com.gh/SubPage.aspx?pageid=1586 by MTN and accessed on March 1, 2013
[4] Source: http://www.tigo.com.gh/Internet/SmartBrowse.aspx by tiGO and accessed on March 1, 2013

owned by Vodafone Ghana. This single source of high-speed Internet connectivity rendered the market basically uncompetitive. (There is a fixed cost for getting the Internet into Ghana and there is no real alternative to that method.) Put another way, there has been a single wire that connected Ghana to the Internet [8].

Fast forward to 2013, Ghana has other submarine fiber-optic cable landing sites. These include GLO-1 (Globacom-1), WACS (West Africa Cable System) and Main One Cable. With their presence, it was expected that the cost of dedicated internet bandwidth would reduce drastically but that is not the case.

In the case of KNUST, until 2010, it had a dedicated internet bandwidth of 45Mbps at a cost of US $22,500.00 per month, exclusive of taxes from Ghana Telecommunication Company Limited (now Vodafone Ghana Limited). In 2013, KNUST is paying the same amount for 155Mbps of dedicated Internet. This is obviously not enough for an educational institution with a total population of 37850, especially when most of the content by these institutions are hosted outside the country mostly by companies in the US.

Compare this to the United States, where there are multiple providers; most of the content on the Internet is generated in the United States for people in the United States; and there are many choices for consumers to access the Internet, as well as many choices for Internet Service Providers (ISPs) both to deliver Internet service to consumers and to connect their services to the Internet.

Nevertheless, Internet cost in Ghana is considered to be very competitive compared to other African nations. In Kenya, Safaricom offers 100Mbps at US $49,535.60[5] per month, AccessKenya offers the same 100Mbps at US $36,298.40 per month. Judging from these two ISPs, the average cost of 100Mbps per month in Kenya is approximately US $40,000.00 [9]. If the relative cost were the same in the US, 1Mbps would cost approximately US $40,000.00 per year. This, definitely makes reliable and stable connections needed for effective work by institutions and corporations out of reach for many. Yes, internet penetration in African nations has increased especially with respect to the population but access is restricted to the privileged few who can afford these exorbitant rates. South Africa, a nation contributing two-thirds of the continent's Internet traffic, is also regarded as one of the countries with high cost for Internet.

Even though the internet penetration seems to increase by the day in Africa, its cost is quite expensive. Due to its importance in socio-economic development, individuals and organizations do everything possible to have access to it.

Listed below are the other reasons for the high cost of internet connectivity:

- Lower cost internet is not available to the end user though there are five optical submarine cables landing in Ghana. This is because Vodafone has a monopoly on the national optic fibre backbone and telephone lines just like the other monopolistic telecommunication companies in the various African nations.
- There is less competition in the underground fibre-optic field.
- High cost of connectivity to consumers' location by third parties such as ISPs after they purchase from the cable companies due to frequent theft of optic fibre-optic cables.

[5] All Currency Conversions by Oanda. http://www.oanda.com/currency/converter. Accessed on March 15, 2013

- Frequent termination of fibre-optic cables due to improper blue prints used in road construction and sabotage by competitors.
- Recovery of initial investments, administrative and maintenance costs by cable companies and ISPs.
- High taxes on ISPs by regulatory bodies in the country
- Reduced economies of scale and a high risk for the ISPs caused by the existence of fixed Internet connectivity. This implies few connections for guaranteed bandwidth within the corporate cycles.
- Limited availability and capacity of national fibre-optic backbones.
- Frequent power outages, hence all the cable companies and ISPs run on standby electrical generators at all their cell sites to avoid interruptions in their services.

3.2 The Effect of Internet Connectivity in the Deployment of Technology-Enabled Educational Platforms

Internet access in Ghana is primarily through mobile broadband (GSM and 3G technologies). This makes access to e-learning content expensive for the average user. Mobile broadband cost on the average is US $0.10 per megabyte of data. An average 10 minutes video on YouTube is 20MB. This makes a total of US $2.00 in a country where the minimum daily wage is US $2.21 [10].

In the case of KNUST, approximately 70% of the students do not reside on the university campus and therefore do not have access to the campus intranet, hence have to access e-Learning materials via the internet which on the average is expensive. These high prices set by existing local ISPs in Africa also deter the academic and research community from accessing global resources.

Even though, most open source e-Learning platforms can function on an intranet network; for a comprehensive deployment, a reliable internet is needed to make it possible. It therefore becomes less interactive especially for students via distance learning and guest lecturers who want to have live sessions with their students. Institutions in developing economies have fewer alternatives available in their quest to remain relevant and competitive. Based on constraints like the scarcity of internet connectivity, they settle for sometimes inferior options which do not serve their needs in the long run. For instance, KNUST decided to use the Zimbra Mail server, as against the widely used Google Apps mail services due to the fact that, the Google mail client cannot be accessed if the internet is down whilst the Zimbra Mail server is available on the intranet.

A large number of libraries in higher educational institutions (HEIs) in the developed countries are now digital with availability of electronic books, journals and other periodicals. One of the main reasons for a library organization to become so deeply involved in what is a technological project was the urgency of the desire to provide access to content that would really impact the academic community. This opportunity however eludes HEIs in Africa. Unfortunately, universities in the developing world where internet connectivity is so unreliable are prevented from accessing these rich digital resources. [11]. In some instances, the KNUST Network Operations Centre needs to shut out the rest of the users on campus to make it possible for a flawless video conferencing to be transmitted especially when enough bandwidth is required for this to occur.

4. Conclusion

To make Internet access more affordable to the average person, the government will have to pass laws that make the industry more competitive. Companies like Vodafone which is a bulk supplier and distributor of Internet bandwidth and the only company that owns fixed telephone lines should be forced to split into smaller unrelated companies.

Until such interventions are brought in, technology-enabled education with its advantages over the traditional form of education would never fully be adopted in developing economies like Ghana.

5. Recommendations

- Issues requiring immediate attention for the use of the internet include pricing structures, monopoly control of internet access as was done to AT&T by the US government, and licensing charges for content.
- Policies should be directed at liberalization of telecommunication networks and Internet service provision, as well as lower tariffs on computer and telecommunications equipment.
- Negotiating for internet bandwidth through economy of scale by a consortium formed by HEIs in the country instead of the individual educational institutions dealing with the ISPs on a one-on-one basis. Ghana Research Network (GARNET), Kenyan Education Network (KENET) should lead in that pursuit.
- Educational Institutions need to build a database of local contents on a nationwide intranet network so as to avoid the need for constant connectivity to the internet. Also, reliable data centers should be set up within the country to host institutional websites and repositories instead of hosting them on servers in North America and Europe which require the internet to access them.

6. Acknowledgement

We are thankful to our senior colleagues in our various departments for their guidance, criticisms, comments and contributions throughout the undertaking of this research. We are also grateful to all those who assisted in data collection efforts and research especially Godwin Amefia; a Research Assistant at mFriday and a final year student at the Department of Computer Science, KNUST; Kwame Nkansah, a Senior ICT Assistant at the University Information Technology Services Directorate, KNUST and Abraham Brew-Sam Jr. of the Network Operations and Infrastructure Department at KNUST. A special thanks goes to Dr. Mrs. Yaanieta Okine for proof reading the paper. Finally we would like to thank all who we are unable to mention here but who in diverse ways assisted us in this research paper.

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Impediments to Bringing Education to ALL

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ABSTRACT

Technological innovations have remarkably changed the concept of traditional classrooms and they have brought in significant changes in the quality of education at all levels. Expanded Internet Access, Open Educational Resources, Massive Open Online courses all are changing access to quality of education world wide. As a result technology has brought in a paradigm shift in education ie., from 'National Education to Global Education'; 'Online Education' to 'Life long Education' for all, 'Teacher Centric Education' to 'Learner Centric Education': ICT's are potentially so powerful tools to extend educational opportunities through online courses to both formal and nonformal, scattered and rural population, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities and the elderly especially for reasons of cost or because of time constraints unable to enroll on campus. These changes have created challenges to the established educational practices at all levels of education in general college and universities in particular. The author of this paper world like to share her reflections on these challenges based on research findings, opinions sought in available literature across India. This paper discusses the various impediments that are experienced by the online learners and how these obstacles could be dealt with and avail the "Best possible learning opportunities" provided by the privileged Electronic Universities for the under privileged, needy and enthusiastic aspirants of India.

Introduction

Driven largely by technological innovation, higher education has embraced the unthinkable ie., globalization. Technology will significantly impact all aspects of higher education from research to communication and teaching learning process. It has changed not only the concept of classroom E.learning but also redefined by the proliferation of Distance education and E-learning. Expanded Internet access, Open Educational Resources, Massive Open Online Courses all are changing access to quality education world wide. For instance, Harward and MIT universities have lately invited the entire world to their free online courses. These technological innovations, technology of education are finally creating a possibility of realizing LINC's dream ie., "with today's computer and telecommunication technologies every young person can have quality of education regardless of his or her place of birth or wealth of parents". The time has come now for the entire world in particular developing countries to test new innovations i.e, online courses for bringing quality in all our lives through education. India being developing country should not be apprehensive about technology. If we, Indians refuse to see the potential of new ideas and technology we shut ourselves from the possibilities the technology offers. ICTs are potentially, so powerful tools to extend educational opportunities especially for those for reasons of cost or because of time constraints unable to enroll on campus.

Challenges related to Colleges and Universities

The author would like to share some of these challenges, success stories due to technology enabled education and measures to overcome these challenges in this paper. Technology has brought in a paradigm shift in education i.e, 'National Education to Global Education' from 'Online Education' for a few to 'Life Long education' for all, from 'Teacher centric education' to 'learner centric education'. These changes have created challenges to the established education systems and practices at all levels of education in India particularly at college and universities. . Poor technological infrastructure support has been reported in many institutions of India (Srinivas 2012). The emerging online electronic universities will expose our country's strengths and weaknesses to the rest of the world. The regular universities in India may lose their intake if quality is not maintained inline with the standard of online courses in teaching and research. Infact, Innovative Technology provides opportunities for us to identify the needs of our communities and learners, envision solution by identifying technological resources and programmes to make it happen.

Continuous technological development and application of social network has been creating dramatic challenges and unlimited potential for innovations, requirements for knowledge and skills to function in this global society. This demands quality higher education at less cost, which will be a financial burden to the Indian universities. On line courses offered by the prestigious electronic universities will create challenges of allocating funds for rapid expansion of universities.

Barriers in the implementation of Online courses

Teacher related challenges

There have been various research studies highlighting the various barriers for the implementation of online courses across the globe such as while higher education institutions and students are enthusiastic about the online courses the faculty seems to be disconnected and lacking interest in e. learning. Nachimuthu (2012) identified barriers such as teachers' attitude lack of teachers confidence, resistance to change, poor administrative support, poor fit with the curriculum, poor training opportunities, scheduling difficulties many professors at the Universities poorly use the technology, their problem is not the innovation but their capability. Universities will have to work towards networking of teaching technologies, redesigning of uncurriculum and learning experiences, which can homogenize higher education system in the country. This requires finance, modern attitude of the authorities and teachers and enthusiasm to implement web-based teaching. Institutions will have to make sure the access of IT to the learners otherwise it may become unaffordable to students from under developed and remote areas or those from low socio economic status. Learners will have to be made familiar with the use of IT in classroom. This requires developing an adequate infrastructure. Preparation of students for a new web-based teaching environment is necessary.

Uma Joshi and others (2002) have identified challenges of web-based technology, in higher education. The first challenge would be in the area of teacher's education or teachers' training. Teachers will have to be ready and trained to use on-line facilities of teaching. Secondly, the sources of knowledge of students have become unlimited today. Teachers will have to be prepared to guide students to use these sources constructively. Teachers will face the challenges of redefining their role in web-based teaching. They will have to develop competence in teaching in the digital world.

Teachers will have to choose between various alternatives while planning web-based teaching such as, whether he/she wants to use online teaching when meeting together in class or when the learners are at a distance or a combination of both. Different strategies will be required depending on these choices. Teachers will have to be careful that in order to use online teaching they do not sideline the pedagogy. The purpose of web-based teaching is defeated if it denies learning opportunities to the large majority of learners. Therefore, the policies for online courses at government level and institutional level will have to be created to provide for such facilities and services, such as free supply of equipment etc. to the institutions.

D R Goel and Chhaya Goel (2013) have identified several challenges and issues related to teachers role in the digital age: It is an age of information and communication technology, but a large number of teachers at all levels are ICT illiterate. There is information explosion and media implosion in all facets of life and living, but still teachers have knowledge poverty. Most of them do not know how to access information. They are not skilled on surfing skills, such as, selecting, skimming, scanning, switching and authenticating. We do not have technology Integrated Education. Even now the technology has 'Guest Appearance' in our Education. Even in this Digital Age a large number of Teachers from pre-primary to higher education are not Techno-Savvy, Info-Savvy and Net-Savvy. We have very thin population of techno-savvy, info-savvy and net-savvy teachers. It is because the education system as a whole has been relatively indifferent towards techno-culture. Our education Radio, Educational Television, Education Computers, EDUSAT SIETs have lost their Education identities except EMRCs who are sustaining and enhancing their identities. It is because these have had a rich cultural heritage as well as will and zeal to modernize. Most of the Libraries countrywide are house of hard books and Journals. There is a need to enrich the libraries through e-books, e-Journal, e-news letters, CDs, DVDs and Digital Networking. Information explosion and constant geographical space demands storage of the learning resources to be in the digital form, the e-form. There is a need to modernize School, College, University and Public libraries.

Teacher Learner Related Challenges

Pathaneni Sivaswaroop (2003) has expressed views expressed by on line learners from the city of Hyderbad citing from Moore, 1997; Davison, 1996; Oliver, 1999, Janet al, 2000; East Mand, 1993, Robin et al 2001, Gehring, 2002: Online courses should provide a good joyful learning experience not just information; it requires proper financial planning and sustain students interest; Moore (1997) opines that there is a direct relation between quality of the programme and the quality of design process and capability of the trainers. A team of specialists need to be involved not alone by the best faculty; Gehring (2002) opines that investing in faculty training technical support and student support are the key requisites for the success of the online courses, he feels that mere investing in latest technology is sheer waste.

As online courses reach the drawing rooms work places, their own places, pace and convenience they need to be learner centered. The online learners need certain prerequisites for the success of their courses such as; access to the technological hardware, support system and get them to work well ; they may have to spend considerable time in learning how to use them (Davison (1996) ; learners need adequate support at the initial stages and it may be gradually reduced as in scaffolding (Oliver, 1999); The learners need to be informed about how to use them on line before they start studying on online (Janet al 2000) ; Moore (1997) reported that students in online felt lectures boring than video conference. They felt isolated and express the desire to interact as it has limited scope on online courses. In this Context Eastmand (1993) has suggested that www.as such is an inactive medium hence it has to be made vibrant as interactive with careful instructional design.

Though numerous, studies have shown that on line learning environments are not only feasible but they have many advantages over traditional education such as the convenience of asynchronous participation, a permanent record of the class and plethora of analysis tools (Hiltz, 1997; Kearsley 1998 as cited by Habibulla Shah and Firdos 2011) Like any new technology the implementations and optimizations of online learning environment needs research and experimentation over a period of time and more to avail the maximum potential this technology offers. For instance the following research evidence form a telelearning centre. Indira Gandhi National Open University, NewDelhi India highlights the feedback of an online course received from a small group of 20 BIT students of Hyderabad: Out of 20 T.Lc centres 80% are male and 20% are female students only. 70% of them have computers at home. However 65% of them are not web connected. At the beginning of the course 85% of them ranked them as average and remaining 15% as Novice/ no experience. 45% respondents felt no need for any training to study on line. Remaining 55% felt need for pre-training. 70% of them had good interaction with fellow students. These research findings reveal that E.universities need to prepare a perfect plan to launch on – line programme besides latest technology and best faculty, they have to concentrate on providing better learning environment student support services and training to faculty and on line facilities.

The growth of the internet and on line learning will be continuous challenge to institutions of higher education. A survey by Song, Singleton, Hill and Koh (cited by Vikas Taneja and Sakshi Parashar, 2011) focused on two aspects: components of on line learning environment that learners recognize as helpful in the learning processes; and components that are challenging in the on line learning environment. The following aspects were identified by the participants: design of the course, comfort with on line technologies and time management. Difficulties in understanding instructional goals and technical problems were both identified as challenges in on line learning environments. Hence effective instructional design for on line courses i.e., the design should focus not only on the technological aspects of the course but also on the goals, objectives and expectations for the learner; Assisting students with establishing community or feelings of connections in online contexts is very essential for the success of the online courses.

Language Related Challenges

In online courses languages play an important role in the present day global e-learning learners with different language capabilities find difficult to participate in the discussion as they need time to understand the dialogue and respond on asynchronous discussion. But by then the discussion might move forward and they may miss the track of it. Moreover a timid learner may find it difficult to enter the online discussion. It may be either due to language problem as most of the Indian students learn English as a second language or lack of technological skills (Jan et al 2000).

Culture Related Challenges

Culture is an important issue in online education as it is global in nature, as Robin et al (2001) reported the interview of the several students. They have expressed that they had to transfer by themselves all the knowledge to their situation and all the examples were from Europe. This example highlights that prominence has to be given to various cultures of the student population in online courses lest they may find difficult to understand to given illustrations

Locale Related Challenges

Laxman Shinde (2012) rightly pointed out that more than two-third of India lives in the villages where majority of the population in illiterate continues to struggle for livelihood and dignified living. To some extent mass media and information technology have linked villages with the main stream interms of sharing information related to business accounting, weather trends and best practices in farming. It has been found that it is not easy to take IT to rural areas due to the problems like, rural environment, lack of infrastructural facilities lack of instructional facilities, lack of awareness, financial support, lack of coordination appropriate allocation of resources, literacy, lack of knowledge of English. Information technology professionals are not interested to go to villages as they think there is no scope, they prefer to go to cities, school teachers are not keen to learn computers as there is no incentive for extra work as computer literacy increases work load. There are no cyber cafes in villages. Due to lack of funds government has provided one or two computers, which doesn't help much, villages need internet connection, phone facility and extra funds for maintenance. Schools and colleges cannot afford it. There has been lack of co-ordination from near by private institution and other universities. Inorder to use computers knowledge of English's required. Due to language problem the students in villages hesitate to learn computers these are some of the challenges for implementing information technology in rural areas.

Hetrogeneity Related Challenges

Raju Narayana Swamy (2012) citing Tinio Victoria L. reveals that diffusion of technologies in Indian higher education scenario would respond to the twenty – first century demands. The contemporary higher education systems are aiming for acquisition of technology skills as part of the core education system. Given the wide disparities in access to ICTs between different groups there are serious concerns that the use of ICTs in education will widen existing divisions drawn along economic social cultural, geographic and gender lines. The introduction of ICTs in education, when done without careful deliberation, can result in the further marginalization of those who are already disadvantaged.

Technical Related Challenges

Madhukar's 2002, cited by Uma Joshi and others 2002 has identified certain impediments related to web based teaching in Indian context. They are limited band width and slow modems hamper the delivery of sound, video and graphics, therefore learners on online courses need to be wellversed in their technical skill, internet navigation and ability to cope up technical difficulties. The proliferation of databases and websites demand information management skills. Moreover access to the internet is still a problem for some rural areas and people with disabilities in India. Social isolation can cause passivity in online courses. Online courses without support services can be a uphill battle for many students. In the context of formative and summative evaluation to use grade essays and performance assessment students require certain amount of personal interaction and communication.

In the new digital environment adaptive capability is the key to survival and growth. Reddy (2001) rightly says that universities in developing countries like India face obstacles such as paucity of funds, material resource, capital equipment, and infrastructure. This requires careful planning by all the stake holders which will certainly pool resources and exchanging expertise in the areas of shared interests.

Success Stories : Technology Initiatives in India

Though there have been several impediments identified by various researchers there have been success stories in Indian context too. India is making use of powerful combination of ICT's such as open source software, satellite technology local language interfaces, easy to use human – computer interfaces, digital libraries etc. with a long – term plan to reach the remotest of the villages. Community service centers have been started to promote – e-learning throughout the country. For instance, major initiatives and policy for introducing ICTs in higher education by Indira Gandhi National Open University (IGNOU) uses radio, television and Internet Technologies; National Programme on Technology Enhanced Learning: a concept similar to the open courseware initiative of MIT. It uses Internet and television technologies; Eklavya initiative: Uses Internet and television to promote distance learning, IIT- Kanpur has developed Brihaspati, an open soure e-learning platform; Premier institutions like IIM – Calcutta have entered into a strategic alliance with NIIT for providing programmes through virtual classrooms; Jadavpur University is using a mobile –learning centre. IIT – Bombay has started the program of CDEEP (Centre for Distance Engineering Education Program) as emulated classroom interaction through the use of real time interactive satellite technology; One Laptop Per Child (OLPC) programe has been introduced in Maharashtra (One Laptop Per Child, 2007).

Polices Related to Web Based Education

Nachimuthu (2012) has shared success stories related to educational portals for web-based education for instance various policies have been launched to improve access equity and enhance quality of education across the country. National Mission on Education through ICT, launched by Ministry of Human Resource development February 2009 is one of them. A national project Shodhganga with INGLIBNET which makes the research, by publishing theses in open access format, based on UGC gazette notification and it can be done for all 525 Indian Universities. Microsoft India has launched an exclusive website for teachers that will help educators in India and 107 other countries develop online connection with each other and share their educational plans.

In India, education undoubtedly is one of the most important investments in building human capital in a Country and a medium that not only sculpts good literate citizens but also makes a nation technologically innovative, thus paving a path to economic growth. In India, many programmes and schemes such as free and compulsory primary education, Education for All movement (Sarva Shijsha Abhiyan), National Literacy Mission etc have been launched by government to improve the education system.

Learning Related Initiatives

In the recent years there has been a groundswell of interest in how ICT has been deployed in the education sector. One of the most vital contributions of ICT in the field of education is easy access to learning resources. With the help of ICT, students can now browse through e-books, results on the Net, online admission counseling, distance education virtual classroom,, online textbooks, scholarship information online sample examination papers, previous year papers etc., overseas education and educational loan can also have an easy access to resource persons, mentors, experts, researchers, professionals, and peers- all over the world. Some of the latest revolutionary changes and innovations in the field of education are conducting online common entrance examination, facilitating students to select the institutions and branches of their choice through web based counseling process and so on.

Vasudha Venugpoal (2013) has reported that once a supplementary tool or an assistive technology, online learning now is emerging as a fast, convenient and contemporary tool for students and teachers. For instances, Atano, An Educational eBook Store, launched its last-minute preparation packs for the CBSE and ICSE board examinations recently. In fact the company also offers a money-back policy. Many publishers have turned to manufacturing online content for students. For instance, classle.net, an online learning portal enables students to interact with various institutions and professionals. Once the students register themselves, they can attend online classes; internet with other professionals and experts in their field. Online learning here involves quizzes, projects, workshops and library and sometimes even stimulated group studies, special classes and test activities before exams. According to the website, nearly 45,000 students and professionals across the country and reputed engineering colleges like IIT Madras, IIT Patna and PSG college of Technology Comibatore are connected through the company. To tackle the shortage of faculty members, many colleges are in the process of installing e-learning systems in their laboratories. Many of them are also intended to assist teachers and aid students with extra training. "E-learning might be the best way to tackle poor-quality teaching", says E. Balaguruswamy cited by Vasudha (2013), former V-C of Anna University. ICT options such as e-learning and Edusat are available for educational institutions but you have lessons at untimely hours. "The strength of online learning pattern," he adds. E-learning platforms such as NPTEL, a collaborative attempt by IITs and IISc, have been received well by students. The IITs have more than 268 courses, giving any one with an internet connection access to over 10,000 video lectures. But it is heavily tilted towards science and technology, unlike universities abroad such as MIT, Harvard and Yale University each of offers over 200 free online courses in subjects including art, humanities, library science and environment, besides sciences and engineering. For the first time now, Anna university engineering syllabus too, is available to students of all branches. With animation and stylized audio-visual content, the application is meant to keep students engaged via small module. BSNL officials say the demand for the tablets is quite high, at least in private colleges where there is a shortage of good teachers. "An engineering student spends at least Rs. 5,000 a semester on engineering books and that too mostly secondhand books with outdated content. There are legal options for acquiring them online- Amazon and eBay. But those options are more expensive than print", says R. Madhusudhan cited by Vasudha (2013), internet security consultant with Anna University. Hence, many students depend on coding websites, engineering tutorials and a variety of sites that offer free books and peer-to-peer file-sharing site. Online learning methods are often dependent on what learning tools you normally use. "Official guides to GRE and GMAT and even course material have been online for a long time. The simulated tests on line CD are the closest to the actual test experience so the preparation is also largely dependent on online tools," says

Roshni Manikandan cited by Vasudha (2013), an English trainer with a GRE coaching institute.

Online learning is extensively used by many software companies. Besides, improved training costs, decreased material costs, there is a great deal of standardization e-learning platforms bring into training modules. While, for instance, last year British Telecom delivered e-business training to 23,000 employees in three months, Ernst and Young condensed about nearly 2,900 hours of classroom training into 700 hours of web-based learning, 200 hours of distance learning and 500 hours of classroom instruction, resulting in a significant cost cutting, say consultants. There is a great deal of discipline that online learning infuses in employees, feels Radhika Shekawat cited by Vasudha (2013), executive with IBM technologies. “On-line learning is the best way to gauge employee’s capabilities and make sure they undergo refresher courses. There are timely tests, evaluations but it is between the employee and the project head. The practice tests are not even monitored which give every employee sufficient time to realize and work on her areas of strength.” But for all these developments, there are at least some for whom e-learning is yet to be part of life “I will prefer print to online books. I get easily distracted, or not being able to underline the text does not make the process complete for me,” said Aishwarya Gopalan cited by Vasudha (2013), a final – year MBA student.

Best Practices in Colleges of Education

Sunil Behari Mohanthy (2012) has cited Rama and Lakshmi (2008) regarding the best practices in the colleges of education to improve the quality of education through technology: They assessed the extent to which technology integration has taken place in selected teacher education institutes and the way in which it is attempted. Out of 275 responses, best practices of ICT integration were reported in 20 institutions. The study found that teacher education institutions have failed to provide adequate access to technology either due to limited availability of machines or time constraints in accessing the available technology. As regards nature of use of technology in teacher education, they stated that, “it is pertinent to note that most TEIs do not insist on the use of any technology, even those that are not computer based during teaching practice” (p.6). In case of 18% institutions, use of computers for curriculum design and development, CAL, teaching/ learning, including practice teaching, material development by teacher educators, research and development by teacher educators, research and development were found. About one fourth of these institutions used multimedia presentation. Descriptions of a few practices: B.D. Shah College of Education, Gujarat, Patel and Raval (2008) cited by Sunil Mohanthy (2012) reported that the ICT course helped teacher trainees develop skills in using MS publishers and CoreDraw software in preparing and designing the college magazine using the search engines in surfing Internet websites and keep themselves updated with latest information on various subjects of interest. They colud prepared digital lesson plans on their own in the school subjects; Dahiya (2008) cited by Sunil B. Mohanthy the institutions developed E-books and resource books and resource books for Education technology – towards Better Teacher performance and improved testing in research methodology and statistics;

Padma (2013) reports that St’ Anns College of Education Autonomous) Mangalore has introduced ‘Computer Education’ paper in the B.Ed curriculum. All the students of the college B.Ed, M.Ed and Ph.D are encouraged to browse the internet in the college, for the preparation of their lessons, assignment, dissertation and Doctoral thesis. The faculty to use the LCD presentations regularly in curricular and co-curricular activities. The college to has digital language lab and computer lab for the benefit of the students. ICT is focused in research teaching learning process and assignments very effectively.

Government Schemes and Polices in Higher Education

India has actively promoted the use of ICTs in education sector ranging from radio to satellite based interactive television. The GOI has implemented several national as well as state precise schemes that run parallel to large number of privately led ICT initiatives at school and higher education levels. The Knowledge Commission Report constituted in 2005 suggested for the creation of knowledge in science and technology laboratories. It also suggested for improving the management of institutions engaged in Intellectual Property Rights. Yashpal Committee gained a deeper understanding of the critical issues afflicting the Indian higher education (An Interim Report). The challenge that the universities and other higher educational institutions have to respond to is how to connect up the fragmented reality that has resulted from the powerful forces of modernity. The Twelfth Five Year Plan proposed for improved technology for education delivery at higher education level. Technology for enhancing the teaching – learning experience will ensure better outcomes. It suggests that India's higher education can be expected to be better aligned to industry and global practices, and be more transparent and inclusive by the end of Twelfth Plan Period, provided the Government is able to create an enabling regulatory environment and put in place robust implementation, monitoring and quality assurance mechanisms. The government intends in higher education institutions with a GER of 25.2% by the end of Twelfth Five Year Plan through the co-existence of multiple types of institutions including research – centric, teaching and vocation – focused ones (Higher Education in India, Twelfth Five Year Plan (2012-2017) and (Beyond).

Suggestions for the success of online courses

The success of the on line courses (Anjali 2007) through electronic universities depend on the content chosen. For instance electronic universities should help humanity to meet critical challenges such as hunger, homelessness, disease and pollution faced by several countries. The courses offered should contain feasible alternative solutions for solving global problems; Most uptodate research methods need to be undertaken by the centers of excellence recognized for higher quality to assist the researchers in all the developing countries especially in India; Electronic universities should improve and complement the existing higher education institutions. They should eliminate the fear of depersonalization caused by technology; E-university should become 'transpersonal' to address the needs of all the world's children for health care, education, food and clean air, water, feelings and ideas must be shared across the world. These universities facilitate electronic exchange of education affordable by reducing communication costs in their online courses. The poverty of the underdeveloped countries does not result from a lack of resources but from lack of learning, the ability of uses resources. Despite reducing the costs of exchanging courses and lectures, some countries like India cannot afford even the initial demonstration and experimentation. Anjali 2007 suggests developing and receiving software for every school and home. The forth coming combination of telephone, television computer, Satellite dish receiver and radio connected to the World Satellite Network can make it possible for the developing countries like India to by pass all of the interim steps and enter in to a global education system at affordable costs. Provide vouchers to the poor and underprivileged that allow students to connect electronically to the best possible education.

This kind of aid needs to be offered by Japan, Europe, Australia, and North America which would help the world's poor especially India to solve their problems.

The stakeholders should be convinced about the need of technology for teaching and learning. The consistency of the equipments and its integration into the classroom should be convinced. Establish clear lines of accountability of inspection and maintaining quality control of classroom technologies. Maintain supplies appropriately and take new approaches (including staff training) to guarantee speedy responses to breakdowns. Offer training programs and launch particular venues in which faculty can come together and exchange experiences with usage of software used for instruction. Universities should reorganize institutional support programs to formulate them as efficient as possible. To supply the finest opportunities for each student's learning the University needs to guarantee system than can deal with range of problems.

Maximizing students learning through ICT based pedagogy

Some of the researches show that focusing purely on the technology would be wrong. The main focus should be on learning rather than on technology. It is critical that research should explore not only the development of ICT to be used, but also the role of effective pedagogy that can maximize students' learning using ICT tools. It has been widely recognized that harnessing the power of ICT requires appropriate learning strategy to harmonize effectiveness in learning with technology role. On the other hand the significance of face-to-face instruction can't be ignored since the live human interaction in 'teaching' (or learning) can't be denied a large extent. Keeping all these in view, a consensus has emerged among educationists working in the area that there is a need for tapping the wide applicability of online learning with face-to-face instruction and then evolve 'Blended Learning'. In actuality, blending of face-to-face instruction with various types of non classroom technology mediated delivery has been practicsed. In general terms, blended learning combines online delivery of educational content with the best features of classroom interaction and live instruction to personalize learning, allow thoughtful reflection and differentiate instruction from student – to student across a diverse group of learners. In other words the integration of face-to-face and online learning to help enhance the classroom experience and extend learning through the innovative use of information and communications technology.

Government and National Support

Successful implementation of ICT requires strong national support from government and local support from relevant institutions and education authorities. Cost is an important issue that decides and guides the adoption and growth of Information and Communication Technology especially in developing countries, the institutions which are granted public status and are supported by government funds, as well as those, that are larger in size are the ones to adopt the new technologies to support education. However, it is also observed that since technology adoption involves high fixed costs, institutes, which implemented such technology, did not upgrade it as time progressed. The presence of an ICT integration has been initiated successfully. Along with ICT training, one needs and ICT related support mechanism to gradually induce the integration. This is needed as many teachers face technical difficulties may tend to revert to the older teaching (non-ICT based) methods. Teachers need support in using and integrating ICT into the curriculum and teaching. Teachers, who perceive greater ICT – related support being available to them, use technologies in their teaching much better.

Conclusion

It is true that technology enabled education especially the current invitation from Harward and MIT universities for free online courses to provide the quality of education all over the world for every young person regardless of his or her place of birth or wealth of their parents. The author of this paper strongly recommends that electronic universities entry through online courses should be permitted and encouraged in India inorder enhance quality of higher education. However this technological educational opportunity is going to create a number of challenges as reported earlier and an eye – opener for the developing countries in general India in particular for instance, Indian universities are forced to think of some measures to provide quality education at low cost in order to attract the students lest they may lose their intake due to online courses.

The Indian universities are forced to tackle the financial and infrastructure related problems in rural as well as urban areas of the country catering to the ICT needs and interests to provide quality education for the economically, socially, culturally, geographically, gender based and differently abled students by involving stakeholders and electronic universities in solving the problems. Indian universities are motivated to prepare a perfect plan to provide better learning environment student support, training faculty requesting electronic universities to grant a number of projects in this context. However electronic universities can utilize the expertise from the developing countries to design curriculum learning modules to make the online courses effective learner centric learner and learner friendly considering language and cultural related issues.

Indian universities too can take initiative in coordinating with private institutions with better infrastructure facility in the vicinity to provide conducive learning environment for technology enabled education. Universities can motivate the government of India to issue the loan with no interest to purchase the computers with internet facilities. They should all see that telephones are technically improved to have better and easy internet access and they should make local calls free to make internet accessing affordable. It is advisable to electronic university to think and work together with well establish to universities to extend their educational facilities through a number of projects to the aspiring youth, needy and under privileged.

For improved quality of education in online courses 'learning teams' need to design 'educational modules' that are adaptable from every country to country to improve the quality of instruction. To sustain higher quality, a contribution of international access connecting both students and teachers to the places where the best quality exists. The global higher education network should work as a window on the world helping everyone to get connected to an electronic learning center for all ages, a place for guidance, testing, tutoring, counseling and acquiring the skills in using the electronic technology that one uses to learn at home and at work. Online courses should nurture our minds our capabilities beyond levels of literacy to new levels of understanding and intelligence. They should empower the learners as better thinkers learners and problem solvers; Electronic university should transform it self as a 'Global village Green' where we meet to explore how to be better human beings and care for ourselves, our culture and our planet. Online courses should create safe, supportive and vital learning community so that they listen to each other with care and compassion work in coordination.

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The MIT LINC 2013 Conference

Parallel Presentations

Session #2
Innovative Online Learning Environments

- "An M-Learning Maturity Model for the Educational Sector" presented by Luis Fernando Capretz (Canada)
- "Ubiquitous Learning: The Lived Experience of Students Learning with Smartphones" presented by Nee Nee Chan (Malaysia & England)
- "Constructionist Learning using Spreadsheet Based Models on Tablets" presented by Manu Sheel Gupta (India)
- "iPodia: Borderless Interactive Learning" presented by Stephen Lu and Ang Liu (U.S.)
- "Rethinking Learning" presented by Leslie Richards (Canada)
- "An Asynchronous, Personalized Learning Platform—Guided Learning Pathways" presented by Cole Shaw and Soheil Sibdari (U.S.)
- "Diversity in MOOC Students' Backgrounds and Behaviors in Relationship to Performance in 6.002x" presented by Jennifer DeBoer and Glenda S. Stump (U.S.)

An M-Learning Maturity Model for the Educational Sector

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Abstract

Educational institutions are increasingly becoming interested in adopting alternative technologies as a mode for imparting education. Mobile technologies are considered to be the next frontier as they have the capability to provide high-quality learning experiences, and satisfy the increasing demand for mobility and flexibility. In view of the ubiquitous presence of mobile technology and the immense opportunities, there are favorable indications that the technology would be introduced as the next generation of learning platforms. The adoption of M-learning also has its challenges. A lack of a comprehensive assessment and evaluation methodology is seen as one of the major roadblocks in implementing the technology. The present paper has used the framework of the Capability Maturity Model (CMM) to design a model for M-learning within educational institutions. The objective is to identify key processes and maturity levels that would make the transition of learning processes from old to new, smooth and viable.

1. Introduction

The contemporary education process is expected to change because of the far reaching impact of mobile telephone technologies. Researchers such as Valk et al. [1] have pointed out that mobile technologies must be used in the educational sector, in view of their massive growth and acceptance within all levels of the society. However, the actual design of a learning platform based on mobile technology is still in the development phase, exploring and assessing several methodologies that can be used. Kukulska-Hulme and Traxler [2] and Chan et al. [3] have explored the notion of M-Learning within a one-on-one setting (i.e., each student has one independent mobile device during the learning sessions). Also researchers, such as Kukulska-Hulme et al. [2] and Engel et al. [4], have explored M-learning in a different context. In addition, there have been several other experimental studies to understand the ways in which mobile technology can be used to impart education [5][6].

Some of the institutions offering higher education have also implemented experimental initiatives for M-learning that have been successful [7] moreover, a recent case study by De Waard et al. [8] demonstrate the merger of the Massively Open Online Course (MOOC) format with M-Learning. In fact M-learning systems have already been developed in the US as well as in several countries in Europe. The technology has also been proven as an effective channel for providing inexpensive distance education for varied purposes in Asian countries like South Korea, Bangladesh, Malaysia, and Japan [9].

A common conclusion from these studies is an agreement that the process would be challenging, especially when the traditional background of the educational institutions are taken into consideration. Wishart and Green [10] consider that the most prominent challenge in the M-Learning process is the insufficient evaluation of implementation of the mobile technologies on a non-experimental basis. Further, while educational institutions are still prioritizing their strategy and operation in terms of adopting M-learning principles, the technology itself is changing rapidly. The main advantages of adopting an M-learning platform for educational purposes would be an increase in the number of students having access to education as well as a reduction of set-up costs for the educational institutions involved [11]. One of the objectives of this paper is to address the benefits that educational institutions will get at various stages of adopting the M-learning platform for imparting education.

The primary research question addressed in this study is: Can we creatively apply the CMM concept to the M-learning domain for the educational sector? The objective is to evaluate the progress of educational institutions in an objective manner and to provide a clear roadmap for achieving a complete integration of M-learning within educational institutions so that they achieve the maximum benefits from introduced the technology as part of their education program

It has been observed that educators find it difficult to learn and apply the principles of new technology to their teaching of students. The problem is even more acute when the case of technical teaching is considered [4]. Educators have often been skeptical of applying new technologies in the teaching program. However, several studies have demonstrated that technologies, such as E-learning, M-learning, and other advanced methods, could be equal to the traditional lecture format [11].

In the absence of an overall framework of assessment that ensures the successful adoption of M-learning and, consequently, improves the educational process, the techniques are bound to be viewed with suspicion. The CMM model was initially suggested to assess the improvement of organizational processes during the process of software implementation [12].

The paper is structured as follows: Section II enumerates the research objectives. A review of the existing and relevant literature is presented in Section III. Section IV presents an analysis of the existing models that have been used as a basis for the design of the current framework. The actual model has been depicted and described in Section V. Section VI presents the conclusion from the study comprising an analysis and discussion on the proposed model and possible directions for future research.

2. Goals, Objectives and Limitations of this Research

This paper assesses the validity of the process of applying CMM to the M-learning platform. The CMM has been utilized for two purposes in the paper – to provide clear guidance that would enhance the process of adopting the M-learning platform and to integrate the platform with the presently used E-learning program. The possible advantages of using the modified version of CMM for M-learning will also be discussed at the end of the section. Thus, the objective of the paper is to answer the question: How can we creatively apply CMM to the process of M-learning? The intention is to effectively use the model to evaluate the performance of the M-learning platform and consequent stages of development. The research is limited to the evaluation of CMM as it applies to M-learning and mapping it precisely to define the process to make it comprehensive. The development of a working M-learning platform would involve knowledge of several aspects of pedagogy, such as learning and cognitive theories, that are not a part of the present study.

3. Literature review

The concept of M-learning has been a part of several debates. The main question to be asked here is: Does the concept of mobile learning refer to the mobility of the student (as considered by Kukulska-Hulme [2]) or does the term reflect the mobile device itself (as articulated by Traxler [13])? Both points of view are equally relevant and powerful and choosing either would have a significant impact on the implementation process. One aspect common to both is that the concept of M-learning encompasses learning within the traditional classroom setting as well as the possibility of formal/informal education outside the traditional classroom set up using any of the possible mobile devices. It is also clear that interaction with mobile devices is just one part of M-learning; the most important part is characterizing these interactions so that they support the education process.

In this context, M-learning can be defined in the words of Schofield et al. [14] as the process where both personal and public understanding of a concept occurs only through technology-supported conversations and interactions between individuals. Looking above at the two debated views of M-learning, it is clear that this definition is more in line with the point of view supported by Kukulska-Hulme et al. [2]. This because it can be argued that, in this case, the location of the people was vital, in the sense that they were separated enough so that interaction between them was possible only through the mobile devices. Also, people were free to move without affecting the overall learning process.

Choosing one definition of mobile learning from the many proposed is a challenging concept because the mobile-platform is undergoing rapid transformations with new technologies being developed every few months. The newer versions are getting more sophisticated but the older phones are still popular. The platform is not limited to mobile-phones, as the name suggests, but includes a host of other devices including notebook computers, digital cameras, music players, and even gaming consoles. However, unlike the E-learning platform, the m-learning platform is device-dependent and is restricted to the use of devices with mobility features. El-Hussein and Cronje [15] have emphasized this aspect clearly while defining M-learning in their paper, when they note that the devices used for M-learning must be noticeably mobile. However, the architects of M-learning models must not consider the process as merely the extension of E-learning using mobile devices. The focus of designing M-learning applications must be specific to the usage of mobile technology, using all the advantages the technology offers to facilitate the process of learning. Figure 1 below shows the different ways in which M-learning can be utilized in an education setting.

Figure 1. Utilities of M-learning in an educational setting [14]

3.1 Advantages of M-Learning

The process of M-learning offers advantages such as simplifying the learning process as well as the offering the possibility of anytime-anywhere learning. In addition, using this mode to impart education can save the time and efforts of teachers while making the entire experience enjoyable for students [11]. In order to achieve the maximum educational benefits from the M-learning platform, one must be aware of its specific features. Figure 2 below shows the characteristics of M-learning. Figure 2 shows the characteristics of M-learning.

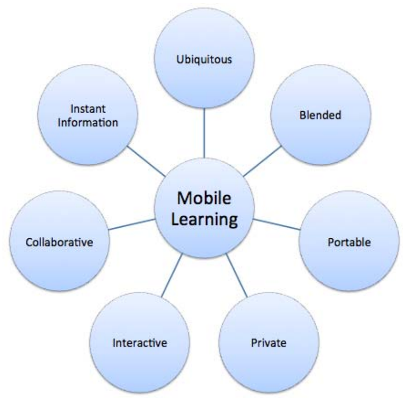

Figure 2. The characteristics of M-learning [16]

From figure 2 above, the characteristics of M-learning, as enumerated by Ozdamli and Cavus [16], are as follows: (i) ubiquitous, i.e., present everywhere, (ii) blended, i.e., unified, (iii) portable, i.e., can be conveniently moved from place to place, (iv) private, i.e., maintains the confidentiality of the learners, (v) interactive, i.e., offers two-way communication, (vi) collaborative, i.e., encourages shared learning, and (vii) instant, i.e., real time information exchange is possible.

3.2 Disadvantages of M-Learning

In order to better understand and effectively use M-learning, it is also essential to understand the limitations of the platform. For a start, there are set up costs involved in equipment acquisition, in addition to the training costs for instructing the teachers and students on how to efficiently use the platform [17]. A major concern for the educational arena has always been copyright and security issues regarding the learning material. Internet and mobile platforms are notorious for flouting the rules, leading to frequent accusations of infringement. Using the platform will inevitably expose the training matter to individuals who are unauthorized to view/use the information, if sufficient security measures are not used However, the creative advantages M-learning offers to enhance the learning experience, for both workplace and institutional education, goes a long way towards balancing out these disadvantages [18][19].

3.3 Challenges in M-Learning

The process of evaluating the M-learning platform is fraught with challenges on the part of both students and educational institutions, especially in regards to the perceived benefits. This section will concentrate on discussing the theme.

Review of Current Evaluation Frameworks

As the field of M-learning is still in its infancy, few frameworks and models have been advanced and evaluated by researchers. A review of the relevant literature shows that Vavoula and Sharples [20][21] have proposed six complications in the assessment of M-learning: evaluating the current learning settings and analyzing the possibility of meaning in different settings (setting includes physical and social environment, learning objectives, tools, and methods); deciding the assessment methods and outcomes for mobile-learning (existing learning assessment methods have been validated by long-term research); evaluating and presenting ethical guidelines for mobile-learning platform; understanding the impact of the high technical nature of the mobile-platform in an educational setting; evaluating the process of mobile learning platform on a long-term basis to understand the change process between the traditional and the new learning context (as a result of M-learning); and assessing and presenting the best mix of formal/informal settings for M-learning in an educational setting.

Vavoula and Sharples [21] also present the theoretical framework given by a previous researcher, Meek, for assessing M-learning in an educational setting. The framework known as M3 assesses the mobile learning platform at three levels: micro at which only user experiences are assessed; meso at which the overall learning environment is assessed; and macro, which assesses how the new platform blends into the established set ups of the educational institutions. Several suggestions have also been proposed to modify the framework for future researchers.

In this context, the six challenges specified by Vavoula and Sharples [20] in evaluating the M-learning process need to be addressed methodically. The challenges can be enumerated as: analyzing and capturing learning in or across context, measuring the processes and outputs from the M-learning platform, respecting the privacy of the learner/participant, assessing the utility and/or usability of mobile devices, considering the wider context of an organization or the socio-culture of learning, and, finally, evaluating the resulting informality. The authors have acknowledged that these challenges are a result of the social implications arising from the multifarious effects of using mobile devices, rather than being due to technical aspects [20].

Review of E-learning Maturity Models

Even though the educational institutions rapidly adopted the E-learning platform, the process of inducting a new albeit similar platform is challenging. Success cannot be taken for granted and the implementation process must be tailored to individual educational institutions taking into account their individual geographical and cultural aspects. Thus would ensure that the platform is adopted universally and efficiently within an institution. A review of literature shows several cases where similar implementations were handled with due care and were, hence, successful [4][6].

According to Zhou [22], the currently existing maturity models for E-learning platforms clearly delineate the performance at different maturity levels (even color them differently) This makes it easier to view the process improvement stages, but quantifying the process is still difficult as is the usage of auto-evaluation tools to measure improvement. For this reason, he has proposed a quantitative model that measures the progress of an educational institution operating E-learning programs, in terms of the CMM concepts of capability and maturity. His model is named E-learning Process Capability Maturity Model ePCMM [22].

4. Related Work

The use of the CMM in the educational context is not a new idea as clearly detailed by Lutteroth et al. [23]. Jalot [24] asserts that the CMM can be used as a tool to overcome any deficit in the quality standards of a process in any area, including the educational sector. While the author suggested that he would address the specific requirements that would tailor CMM to be used in the educational sector in future works, there was no attempt to do so. However, while presenting their E-Learning Maturity Model (EMM), Marshall and Mitchell [25][26][27] focused on the enhancement of the process in terms of the software involved as well as the ability of the model determination using SPICE ISO/IEC [28]. SPICE is considered to be the answer to ISO, in line with the five maturity levels given by the Software Engineering Institute for the CMM. In case of SPICE there is an additional level zero, which specifies the condition where the process could not be accomplished or was performed incompletely.

The basic objectives of EMM in the context of the educational sector are similar to that of CMM, while the domain appears to be different. This means that the model cannot be used for the purpose of M-learning. Another model that could be applied effectively is the OCDMM (Online Course Design Maturity model) proposed by Neuhauser [29]. The model is essentially an E-learning's maturity model based on CMM and describes the various stages of E-learning technologies' adoption in an educational institution. The maturity levels in the CMM-based E-learning model differ in the extent to which the technology of E-learning and M-learning can be employed successfully [30] [[31], respectively.

Some of the best practices from EMM and OCDMM can be taken while attempting to fit the levels into the 5-level-framework of the CMM model. One must consider that the model is essentially tailored to the context of the industry. However, aspects such as clear communication practices and approaches for employee motivation should be a part of the educational arena as well. One must admit that an important goal of an educational program is to motivate the students. In addition it is also important to improve the communication between students, student and tutors, as well as students and management. While applying the CMM model to education, these aspects must not be neglected as being parts of the industry that must be pared to fit the model to the educational sector. Developing such a 'culture of excellence' should be one of the targets of educational programs, one that educators are still in the process of figuring out.

In summary, it can be seen that CMM has not yet been applied critically in the educational domain, except by the above mentioned researchers. As discussed later, other maturity models appear to rely on developing a culture of professionalism among students as the onus of the industry. The process of E-learning is considered as a special domain and the culture promoted by the domain is not viewed to be an inherent part of the educational sector but as a consequence of technology. In any case, it can be argued that the E-learning approach cannot be applied directly to the M-learning platform. In fact, the study has shown that M-Learning modules, coupled with certain structural enhancements, have the potential to improve the educational experience as whole.

5. Proposed Architecture for M-Learning Maturity Model

The primary objective of the present study is to develop a process model, which is flexible as well as offering the users a guiding framework for enhancing the process of M-learning. From the literature review conducted in the previous sections, it was found that such a model could be developed on the lines of the existing CMM. CMM is a 5-level model that helps to judge the maturity of the software used in the institutions or organizations. In addition, the model also identifies critical steps and other validated practices necessary to improve the efficiency, effectiveness, and capability of the current process. The five levels of this model, in terms of Paulk [12], are as follows:

1. *Initial: The existing process during this stage can be characterized as ad-hoc. Smaller process steps are not defined at all and the success of any project usually depends on heroics and efforts by an individual or a team.*
2. *Repeatable: The process has matured from the previous stage and includes practices to track schedule, expenditures, and objectives/goals of the projects.*
3. *Define: The process at this stage includes process improvement activities and the corresponding management actions. All the actions are integrated and documented to make them consistent and repeatable across different projects.*
4. *Managed: At this stage, the company has progressed to include detailed and quantifiable measures for process activities as well as for quality of products. Both the processes and products quality are controlled using quantifiable measurements.*
5. *Optimizing: At this stage, the company is capable of facilitating continued process enhancement based on feedback from the process involved, pilot processes, and other innovative ideas.*

As discussed earlier, CMM was originally designed to offer benefits, such as road maps, for enhancing the software development process within an institute or organization. In this section, the focus will be on adapting the CMM model to build it into an M-learning maturity model. Table 1 below shows the five basic stages of the proposed model.

Table 1: High-level view of M- Learning Maturity Model

Level	Stage	Description
Level 1	Preliminary	Characteristics of the Level □ Reactive and experimental stage. □ Educational institutes recognize the need to improve education process with M-learning platform. □ Primary motivations for institutions to adopt the platform are external pressures like adoption by other institutes to provide flexibility and convenience to their students. Key Processes ▪ At this level, the institution has the pilot program for implementation but there is a lack of a vision to guide the implementation. ▪ The institution develops measures to facilitate implementation of prototypes. ▪ This is done experimentally but is hampered for a number of reasons. For instance, the mobile device coverage might be limited or students might not understand the value of the mobile learning environment. ▪ Another limitation in the implementation of the prototype might be the fact that the learning institution might not have the ability to facilitate effective implementation. ▪ In the preliminary stage, most of the universities and institutions do not have clear mobile learning policies and defined objectives to guide mobile learning.

Level 2	Established	<u>Characteristics of the Level</u> ◻ Based on the recognition of the opportunity provided by mobile devices in the education system. ◻ Results in the investment of M-Learning technologies to realize the opportunities provided. <u>Key Processes</u> ▪ In this stage, learning institutions formulate clear objectives to guide M-Learning implementation. ▪ Institutions do not have M-Learning mechanisms to evaluate their systems. ▪ There is a need for improvements in the existing and implemented pilot prototypes. ▪ Programmers develop tailored systems to facilitate the use of mobile learning, such as the Android App Education, iOS App Education, and other platforms.
Level 3	Defined	<u>Characteristics of the Level</u> ◻ The model of mobile learning environment has been developed to measure the quality of mobile learning systems. ◻ The focus on learning mobile systems by institutions features to offer the most mobile platforms. <u>Key Processes</u> ▪ The mobile device is considered as a critical tool in the interaction between students or among students, instructors and administrative staff. ▪ Institutions link their mobile learning strategies with core and technical visions. ▪ Institutions invest heavily in this type of systems to achieve success. In addition to financial investment, institutions must also develop clear guidelines, in order to achieve success.
Level 4	Structured	<u>Characteristics of the Level</u> ◻ M-Learning is characterized by optimization and innovation. ◻ The optimization results in a rich, dynamic, and flawless experience for students and tutors in the use of the system. ◻ The best practices have been defined and implemented by this stage. <u>Key Processes</u> ▪ To solidify their systems, institutions borrow and integrate the best practices from other institutions. ▪ Institutions develop and measure to ensure a real time student engagement and context awareness. ▪ Institutions also develop systems to be used in different mobile devices such as tablets and mobile phones. ▪ The use of mobile device applications allows students to provide feedback, give comments, and share information. ▪ Institutions learn to refine and improve procedures and policies to control any changes experienced in mobile changes.
Level 5	Continuous improvement	<u>Characteristics of the Level</u> ◻ In this stage mobile offering has already been accepted as the best approach to provide knowledge and exchange of information between students and instructors. <u>Key Processes</u> ▪ Institutions are constantly evaluating themselves to ensure continuous improvement and optimization. This helps identify any changes that occur that might limit or change the manner in which mobile learning is used.

6. Conclusions

The use of mobile phones for the purpose of receiving/imparting education is increasingly becoming a practical possibility. The context has been utilized as the underlying basis of this paper to formulate the initial maturity evaluation framework of mobile learning. The paper started with a literature review of the use of M-learning in the education sector, highlighting its opportunities and challenges. Following this, the M-learning maturity model outlined the facilities offered by the mobile learning platform as a mode of providing education, charting its potential growth curve through various stages.

The core idea of the paper is to demonstrate the possibility of adapting the famous Capability Maturity Model, CMM, to sketch the road map of the progress of the usage of mobile technology in education. Both students and educational institutions can be regarded as beneficiaries of the scheme especially if such a scheme is conducted in collaboration with the central education department. It is obvious that the model is far from perfect; however, it serves to show the many benefits of the platform. Real-time implementation of the platform will be necessary to fine-tune the model further.

In summary, it can be said that the primary purpose of the framework is to provide an indicative list of stages and processes within each stage. The framework is by no means complete and might even lack certain key processes that would become evident only after comparing it with a similar project or after implementing the model on a small experimental scale. While not an exhaustive study, the framework still provides key understanding of the process and potential stages for the complete integration of M-learning within an educational institute. Further revision of the model would definitely help in understanding and overcoming potential problems.

As part of future research in this area, we hope to conduct an exhaustive study of the existing M-learning frameworks developed by researchers from different countries and prepare a comparative analysis. Such a study would provide the key points of similarity as well as differences due to geographical/cultural/political/socio-economic conditions in these countries. Based on the study, we expect to formulate an empirical model tailored to the Saudi Arabia education system with a further possibility of statistically evaluating and simplifying the model.

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Ubiquitous Learning: The Lived Experience of Students Learning with Smartphones

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ABSTRACT

The exponential growth of mobile technologies has created additional affordances and new channels of communicating and presenting information. The smartphone, with its multiple applications and features, is creating a new way of ubiquitous learning. Applying the principles and practices of hermeneutic phenomenology, this study aims to gain access to a phenomenon that is often subconscious in order to understand and interpret the participants' learning experiences. Twelve youths in Malaysia participated in three rounds of semi-structured interviews over a period of four months. Preliminary findings suggest that the experience of learning with smartphones was largely perceived as valuable as it was highly personalized and multifaceted. Identity presentation and management were also observed in the multiple constructions of identities through the smartphone usage. The participants' views on the introduction of smartphones in formal learning were nuanced and complex.

1. Introduction

Smartphones are the more expensive versions of mobile phones, with multiple functions, serving as video recorders, camera phones and portable media players with high-resolution touchscreens. They run on mobile operating systems such as the Apple iOS, Google Android, and Windows Phone that can log on and accurately present standard web pages as opposed to only mobile-optimized sites. With smartphones becoming progressively more affordable, learners have these highly technologically, capable computing devices at their finger tips, providing a plethora of services and functions and ubiquitously linked to online networks and databases. Pachler et al. [1] observe that mobile devices like smartphones are becoming increasingly more important in learners' everyday lifeworlds and their significance is seen in their use for meaning making, leisure activities, identity formation, social interaction and learning. There is thus, a compelling need to find out more about how these devices are used in everyday practices and their relationship to learning.

Phenomenology is a human science that differs from other sciences in that it seeks "to gain insightful descriptions of the way people experience the world pre-reflectively without taxonomizing, classifying or abstracting it" [2, pp. 9]. Applying the principles and practices of hermeneutic phenomenology, this study aims to gain access to a phenomenon that is often subconscious and to understand the nature and meaning of the participants' experiences. Research on the student participants in Malaysia learning with smartphones would be able to add to new knowledge as there appears to be no hermeneutic phenomenological research in this area to date. As learning with smartphones is a complex, multidimensional phenomena, the new understandings generated by this study would offer fresh insights on the feasibility and potential of introducing mobile learning to educational institutions.

Malaysia is a significant context to study this phenomenon as its government has been encouraging its citizens, particularly the youth, to embrace communication and mobile technologies. Under its Budget for 2013, youth could enjoy a RM200 rebate to purchase a 3G smartphone [3]. The Malaysian Ministry of Education attempted to introduce mobile devices into the classroom in 2013, but due to opposition from educators, parents and students, it had to defer this policy [4]-[5]. Awareness of the importance of mobile devices and technologies in society and their purported potential for learning is thus, high in Malaysia. A study of the lived experience of Malaysian student participants learning with smartphones would yield new understanding of this phenomenon which would prove useful especially in its implications for learning in formal contexts.

2. Research Phenomenon and Research Questions

Learning is a complex phenomenon and theories and conceptions of learning abound. The complexity is related to learners' cognitive processes and their interactions with society and culture [6]. Learning is thus, multifaceted and context-dependent and at times, subconscious, automatic and unobservable [6]. In investigating the learning phenomenon, the main question in this study is 'What does it mean to learn with smartphones?' As this question includes numerous embedded and overlapping phenomena, which required further exploration, the following sub-questions were investigated:

i. What is this experience of learning with smartphones like?
ii. How do the student participants perceive the nature of their learning with smartphones?
iii. How is the learning related to participants' identity formation and concept of self?

3. Literature Review

The growing body of m-learning research is evidence of its increasing importance with most studies concentrating on mobile system design, and effectiveness of m-learning [7], [8]. Progressively more research studies have focused on 'smart devices' such as smartphones and tablets for teaching and learning in formal and informal learning contexts [9]-[10]. Looi et al. investigated how primary school children in Singapore engaged in "seamless learning" with mobile devices in and outside classrooms [11]. As one of the pioneering projects on the use of smartphones in the classroom, Project K-Nect aimed to deliver mathematics concepts to ninth grade students in North Carolina, America. Since its inception in 2008, Project K-Nect has been reporting on the effectiveness of the integration of smartphones with teaching and learning in areas such as enhanced mathematics performance, better problem solving and collaborative skills among the students [12]. MoMaths is a programme developed by Nokia and in partnership with the Department of Education in South Africa to teach Mathematics to Grade 10 and 11 students in 200 schools. This project has reported an improvement of a 14% improvement in Maths scores for its students [13]. Although most of these research projects on formal learning report encouraging learning outcomes and positive learner attitudes, these are small scale projects involving small groups or larger groups with one subject. There has been anticipation for such small projects to move into large scale mainstream education but that has yet to be achieved.

Sharples et al. [14, pp. 225] defines m-learning as "the processes of coming to know through conversations across multiple contexts amongst people and personal interactive technologies." Pachler et al. [15, pp. 6) builds on this conception of m-learning by suggesting that learning occurs as "a process of meaning making though acts of conversation on the basis of a pre-given, objectified cultural world" that is bound "by rapidly changing socio-cultural, mass communication and technological structures". 'Meaning making' is thus viewed as the link in theory and practice between the everyday use of mobile phones and learning as 'coming to know'. This study draws upon these above-mentioned conceptions of learning to discuss the learning experiences of the participants in Malaysia.

Drawing on Schatzki's [16] social practice theory, Merchant [17, pp. 772] defines "everyday mobile practices" as the "doings, sayings and relating that constitute informal social practice". Such practices are like learners' routines which are open to innovation and change and exhibit "the characteristics of both synchronic and diachronic variation" [17, pp. 772]. Research is emerging on mobile practices [18]-[20] although there needs a more detailed analysis of everyday mobile practices and their relationship to learning [17]. There is also paucity in the literature of how people use these mobile devices to construct their identities in environments that are dynamic and constantly in flux and how these identities are related to their learning and devices. This study addresses this gap by exploring the everyday practices and lived experiences of student participants in Malaysia to reveal the meaning and structure of this learning.

4. Methodology and Method

A hermeneutic phenomenological approach was used as it represented the optimal way to investigate a complex phenomenon that is highly significant and of which there is inadequate information on everyday lived experiences and its relation to learning. Hermeneutic phenomenology uncovers the uniqueness of individuals' experiences with an emphasis on the individuals' historicality or background [21]-[22]. Phenomenology is the study of experience with its meanings. Hermeneutics augments the interpretive element to illuminate assumptions and meanings in the text that participants themselves may have difficulty expressing, hence offering a rich and dense description of the phenomenon under investigation [2], [23].

As consistent with the interpretive research paradigm, participants were selected using purposive sampling strategies like snowball and deviant case sampling to provide information rich studies for detailed analysis [24]. The 12 students chosen were 16-19 years and currently in secondary schools and private tertiary colleges. There is a deliberate mix of students from different educational backgrounds as Malaysian secondary schools presently bans the bringing of smartphones to schools, while private tertiary colleges generally allow their use in classrooms. There would be thus, a diversity of learning experiences in formal and informal settings. The other criteria for the sampling were based on race, gender and at least one year of experience with using smartphones.

Permission for the interviews and recordings was sought from the participants and their parents, and transcripts and interpretations were made available to them to comment. This ensures accuracy of data analysis and interpretation to achieve better methodological rigour. The researcher was careful to maintain "hermeneutic alertness" [2], which is the reflexivity required to reflect on situations and stories rather than accepting them at face value or imbuing them with pre-conceived suppositions. Field notes that were written down after the interviews were instrumental in recording the researcher's insights and reflections for a critical examination of the emerging issues.

The most broadly accepted method derived from hermeneutic phenomenological methodology is the qualitative interview [2]. It facilitates a deep investigation of the phenomenon: there is the exploration and collection of participants' stories told in their own words, and the development of a conversational relationship between the researcher and the participants regarding their lived experience [25]. The choice of semi-structured interviews was to offer better scope or richness in data compared with structured interviews, and enable participants choice to reply to questions, and to narrate their experiences without being constrained to specific answers [25]. Another benefit over unstructured interviews is the comparison of some standard questions across interviews. In this study, it was determined that structured in-depth interviews with 12 individuals would meet the aim of an in-depth investigation. There were 3 rounds of interviews over a period of 4 months conducted until the point of saturation where no new ideas were surfacing. Each interview lasted from 1 to 1 hour 30 minutes and was recorded and transcribed verbatim.

5. Analysis and Interpretation

As this is an interpretive hermeneutic phenomenological study, the analysis and interpretation of the interviews were guided by van Manen's [2] methodical procedures. First, interview transcripts were read carefully and repeatedly for emerging themes: detailed reading at sentence or cluster level, then using the selective or highlighting approach and finally reading holistically. Second, as the researcher dialogued with the texts, themes and sub-themes emerged, and a coding frame was developed from the key words and concepts [2]. Third, interpretation of the themes and sub-themes was achieved through Gadamer's [22] hermeneutic circle and the fusion of horizons. The hermeneutic circle refers to the interpretive process that moves from components of experience to the whole experience and back again and is repeated to enhance the depth of understanding and engagement with texts. The researcher's prejudice and presuppositions are acknowledged and considered as valuable in hermeneutic phenomenological research. In Gadamer's [22] conceptualization, one horizon is the researcher's prejudice and the other is the subject on hand. The aim is for a fusion of horizons as the researcher dialogues with the texts to bring about understanding of the research phenomenon under inquiry.

6. Themes

7 themes emerged in this study and they explicate the meanings of how the participants learn with smartphones in their lifeworlds. The themes are: 'Learning is Different', 'This is My Learning, Not Yours', 'New Ways of Learning', 'Learning, Self and Identity', 'The Paradox of Increasing and Diminishing Value', and 'The Sum is more than Its Parts'. As the themes are overlapping and interdependent, no theme by itself, is representative or is able to solely illuminate the phenomenon. Since this research study is still in progress, 3 themes are discussed in this paper. Pseudonyms are used in the quotations to maintain participant confidentiality.

6.1 The Paradox of Increasing and Diminishing Value

Most research literature reveals positive outcomes and positive attitudes to m-learning [7]. In this study, some of the student participants display a more nuanced view to their learning: it is highly valuable but it can be a "double edged" sword.

> *"I value the ability to know..like have..to have the Internet wherever I am, to learn anything every time I want, you know, so that curiosity, normally always satisfying…It allows me like before debates, if I'm nervous, if I don't know enough, I have the ability to read, the ability to browse through ten articles or something, so I like this idea of being able to know anything I want to know at any time, ya."*
>
> Ben, 17 yrs old, Form 5 student

> *""Err….for the game, 'Bartending', in that way, I'll think about how I would improve my skills, improve things….because for the basics you can't know much, but when you think more, when you know more like what to use to get a better drink, and then you can be…you can actually get more points and you can even make better drinks…The smartphone helps you to learn."* Al, 19 years old, private college student

Learning with smartphones has increasing value because it enriches their lives and is highly prized as seen in Ben's and Al's quotes. In comparison with their peers who do not have smartphones, being able to multi-task, search for information and learn new skills and knowledge gives them a head start in their lives. Playing games on their smartphones has value, as in Al's case, it helps him improve his knowledge and skills in his subject, *Beverage Studies*.

Yet this easy convenience and accessibility to learning anytime, anywhere can have diminishing value to learners. As Deeptzer suggests in the quote below, when something becomes too easy, too available, its value diminishes as learning becomes eminently forgettable, and disposable like some of their lifestyle items. By the term, 'spoon fed', she thinks that with the easily available information at their finger tips, there could be the possibility of not sieving through the information and accepting information without questioning their sources. As a result, there are self satisfied learners who do very little critical thinking.

> *"At times, learning on the go, sometimes you want answers to certain questions, it just is like wanting to know the answers for the sake of knowing the answers and nothing else… So certain things ..you tend to forget the answers and you've solved whatever you want to solve…."*
>
> *"…when you look at it, it actually..everyone is self learning and all that, but the general knowledge of certain youngsters today is very, very low and I feel maybe, it's because of this. Because they are being spoon fed with everything on the Internet. And they're not street smart. Their general knowledge is quite low, which is a very bad thing."*
>
> Deeptzer, 19 years old, private college student

Bloggergirl was of the opinion that learning with technology and the contents she generated online were more transient in nature and less valuable. This was paradoxically due to the ease of this learning and its outcomes.

> *"We tend to hold on to material things. I think that's not only because of the technology. But because if you write something or you draw something really nicely, put more effort into it, so you are more likely to treasure it. As opposed to doing it online where you can tweak it or have it deleted instantly."*
>
> Bloggergirl, 16 yrs old, Form 4 student

Chuck, another participant is an avid reader of e-books (*4687)* on his smartphone and he spends up to 3-4 hours a day reading and searching for information. He is conscious of excessive use of his media and smartphones, calling it "double-edged", and like many middle class Malaysians who value education, he is concerned his smartphone overuse may affect his studies. The smartphone thus, brings increasing and diminishing returns to participants and their lives.

> *"Ya, because everything has its good and bad, double-edged, that's exactly what I'm trying to point out. If you use it for..yes, it's really useful for information, communicating back but if you harp on it too much, it can take over your entire life. You'll just do this and stop socializing and stop connecting with people, I mean you're just doing it virtually and it's not helping you... And you just waste all your time on it and it will affect your studies*."
>
> Chuck, 17 years old, Form 5 student

6.2 Learning and My Selves

The second theme concerns identity formation among youth as they consume media and technological resources using their smartphones. Through their use of social networking sites every day, participants display their need to belong to different communities, resulting in the construction of multiple identities [26].

> *"..you can go to a person's Facebook page, and Twitter page, and you can find that there are an entirely different person on each. On Facebook there are cheerful and all that. But on Twitter they post things like, "I am facing depression". Facebook is how you want people to see you. Twitter is who you really are. Because Facebook is too public, errm there is also the question of 'face', on Facebook there is the unconscious part where we don't want people to judge us, and in Twitter it's more like a personal group."*
>
> Stevie, 16 years old, Form 4 student

Among the most popular mobile applications used by participants are those to access *Facebook* and *Twitter*. According to Stevie, users displayed 2 different identities in *Facebook* and *Twitter*. *Facebook* entries tended to be cheerful and happy as users were presenting their 'public face'. As the Asian concept of 'face' (prestige, reputation) [27] is involved, Facebook identities are constructed and presented to enhance their status and image. *Twitter* is shared with a smaller circle of close friends where feelings and thoughts are bared and it functions for support and bonding purposes. Buckingham [28, pp. 6] suggests that identity at the intersection of technology and identity is a"fluid, contingent matter" and it is "more appropriate to talk about identification rather than identity". Thus, according to this perspective, learners learn subconsciously about identity presentation and identity management as can be seen from the quotations below:

> *"Facebook is…it's like an open book to your life. Sometimes you get addicted to your smartphone, everything you want to post on Facebook, you want to let your friends know what you are doing. So it's become like this thing… Errr I am having lunch now say at Delicious. Then I take a picture of the food, and then I say "Oh I am having lunch at Delicious" and you post the picture on Facebook. Actually these things are not really necessary to go on Facebook. But we actually do it because we want to let people know what we are doing…And you just want to show them what you are doing is better than what they are doing."*
>
> Deeptzer, 19 years old, private college student

> *"So you add them on Facebook, you look at their pictures, you look at what they like. You look at how they type (write). Even… it tells you more about the person itself. As in like… when people talk they have their own way of talking. Some talk very sarcastically, some talk very joyfully. Things like that. So even the way you type… you can sort of tell what … what emotion they are trying to link on to their messages."*
>
> Andy, 18 years old, private college student

Not all the participants were avid users or supporters of *Facebook* and *Twitter*. Some expressed their disapproval or dissatisfaction with what they perceived as the inane comments posted or "the showing off" or "keeping up with the Jones" mentality of some of their 'friends'. All, however, stated they still "checked in" to find out what their friends were doing and participate in the maintenance of their communities through posting their comments, stories, photographs and articles they wanted to share with friends.

> *"My wife. Well...girlfriend, you can switch and you can have a lot. This...I...I don't think I'm going to part ways with it (smartphone). And besides I use it way too often and it's always there for me. It helps me through a lot of things. What wives or husbands do... I can say I'm married to it."*
>
> Chuck, 17 years old, Form 5 student

As participants were reliant on these mobile devices for their everyday needs, they developed highly personal relationships with their smartphones, describing them as "buddy", "companion", "friend" and in Chuck's case, as a "wife". These comparisons take the form of people metaphors, a suggestion that the devices have assumed the significance of a person; a symbol of the growing importance of the smartphone in their lives. They described their feeling of loss if they were to part with their smartphones or to lose them. Smartphones, hence do not only represent their learning and life-styles, they are inextricably linked to their sense of selves and identities.

6.3 This is My Learning, Not Yours

Pachler et al. [15] suggest that users of mobile technologies appropriate socio-cultural resources for their media consumption and learning and in the process, construct their own lifeworlds and personal identities. Learning, thus, is always subjectively meaningful and highly personal as in Al's quote:

> *"When you use a smartphone, you'll be more independent and you..would have ways of learning things even faster cause when you search for things you want to know...for once you've read, you..<u>it actually sticks in your mind</u>. When people say to you something, you won't really get caught in your mind. But when you read something and search for it, you really know the effort you use. It makes you learn better."*
>
> Al, 19 years old, private college student

Academic learning or "schooling" was perceived as 'YOUR" learning as it means studying in schools, colleges and universities to obtain certification to meet the expectations of parents and society. The associations they had of academic learning were of compulsion, obligation, reward and punishment, and rote learning as seen from the quotes:

> *"I go to school because I have to, but I don't really learn that much. As much as they want children to learn…It's very much forcing information into your brain. Especially in Malaysia where they try… exam orientation…. their learning is sort of put on to you and you are obliged to do it. Not because you want to do it. As opposed to subconscious learning or learning by yourself, then you sort of have the passion or the initiative to do it yourself."*
>
> Bloggergirl, 16 yrs old, Form 4 student

Therefore, ubiquitous learning with smartphones, with its positive associations to learning could create significant opportunities for education, creativity and communication. There have been recommendations in the research literature for the potential of mobile learning in educational institutions to be exploited [14], [15]. However, significant challenges abound as there are tensions between the traditional model of schooling and mobile learning [1], [14]. The present school system is structured around rigid timetables, age-grading and accepted academic accreditations and it has struggled to adapt to new learner-directed technologies where the pursuit of learning is based on personalization and ubiquity [29].

Malaysia provides a good case study to illustrate this tension. The Ministry of Education (MOE) in its ambition "to encourage educators and students to embrace information technology in the 21st century" proposed in July, 2012, to allow students to bring mobile devices to schools in 2013 [4]. The ensuing, vociferous opposition from educators, parents and students resulted in the U turn in policy in October, 2012, 4 months after the initial announcement [5]. Newspapers and online forums reported mixed responses to MOE's proposed policy [30]-[31]. In particular, The National Union of the Teaching Profession and the National Parent-Teacher Association were reported to be against this initiative. Opposition was due to perceptions of mobile phones as disruptive devices with potential harmful effects on the social and moral order in schools [30]-[31]. There was a paucity of discussion on the potential of mobile learning and the MOE did not provide any positive models of such learning or examples (within Malaysia or in countries like South Africa) of successful implementations in schools to the public. Although there have been small scale mobile learning projects in Malaysia, notably in Mathematics [32], the lessons learnt could not be used for the implementation of this magnitude.

As the interviews were conducted during this controversy, participants were asked for their views on the introduction of mobile phones into their classrooms. All 12 participants believed that mobile devices should not be allowed into the primary and secondary school classrooms. The fundamental reason was that mobile devices were viewed as disruptive. Their views were conflicted as they wanted to bring their mobile phones to school as the devices helped them in their learning but they could not envisage it being successfully used in the classroom as they had no positive models for comparison.

> *"(Teachers)..won't allow it. The teachers won't know what you're going to search for. So, I mean, some students might be searching for games or searching for some irrelevant things to the topic of task. So, they would basically not allow it. Yeah, I don't think it would work. Like currently the private school, Sri Cempaka, they allow students to use laptops in class.. They may be playing but pretending and the teachers cannot...so it's not helpful."*
>
> Andy, 18 years old, private college student

> *"We want to say yes as we all want to bring our phones to school but in a debate, we'll say no. It does more wrong. Let's say in a boys' school, won't they use in pornography?"*
>
> Stevie, 16 years old, Form 4 student

Their recommendations for smartphone use in the tertiary classrooms were to use them only to record lectures and to view videos. They were ambivalent about using smartphones in class although 6 of the 12 participants were in private colleges where mobile device use was allowed. While giving them advantages over peers who did not have smartphones to search for answers in class, they reported that they also checked their social networking sites while the lecturers were talking and they knew this was probably not wise or correct as they disapproved of this behavior in others.

This inability to visualize using smartphones successfully in class could be the result of what Tyack and Tobin [33] suggest is the “grammar of schooling”. Teachers, parents and students have an internalised model of what a real school should be like with its rigid structures, timetables, classrooms and lectures and there would be resistance to innovations that are perceived to be disruptive. In addition, the ubiquitous learning with smartphones, intertwined with everyday media use was seen as “this is my learning, not yours”. To have some of these mobile learning practices transferred to the sphere of academic learning was to lose the personal freedom and choice that they associate with their smartphone learning and with it, their privacy and personal space from teachers and parents. The implication for formal learning is that the integration of mobile practices into the classroom may not be feasible with the present academic model of schooling. As the apprentice system of the Middle Ages gave way to institutionalized learning in the nineteenth century, mobile learning and its different and multiple practices could be a harbinger to a new model of education.

7 Conclusion

This study through its use of hermeneutic phenomenology methodology and methods, presents the experience of learning with smartphones directly and evocatively to encourage readers to enter imaginatively into the experiences described. This provides the means for deepening our understanding of the lived experience of learning with smartphones. As this is a study in progress, the findings are preliminary. The insights provided thus far, are that learning was highly personalized and reflective of learners’ needs and purposes. Participants generally perceived this learning as highly valuable although they understood that it also had negative implications. Their identities and relationship with their use of technologies were fluid and contingent upon context. Since they did not have any positive models of smartphone use in the classroom, they could not imagine how these mobile devices could be used without disruption to the “grammar of schooling”. Significantly, they regard their learning and media use with their mobile devices as predominantly their personal learning and appear not to want intrusions into this personal space and boundary. Hence, adoption or integration of mobile learning and its present practices into academic learning may not be feasible or desirable given the existing tensions.

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Constructionist Learning using Spreadsheet based Models on Tablets

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Abstract
The use of the tablets is on the rise, and here to stay. Being portable, they make it easy for the user to engage in a mobile fashion. Learning can be greatly enhanced, if this new platform is harnessed to its maximum effect. This paper describes such an attempt, with the focus on learning by doing and learning by sharing. Building on these approaches, we have implemented a suite of software applications based on the familiar spreadsheet interface, which aim at a greater user interaction, thus facilitating learning. The design, development, and implementation of this attempt has been discussed.

1. Introduction

E.C. Tolman's field cognition model of learning pertains to the tendency to arrange our perceptual field in a certain configuration. According to him, these tendencies could be modified with experience. Our field cognition modes are our preferences for learning certain things faster than certain others [1]. With the right set of experiences, a seemingly complicated task can be made appealing and consequential at the same time.

Learner has to be seen as a pro-active agent of information and learning has to be visualized as a change in the way information is processed as the result of the experiences that the learner has had or is having [2]. The experiences that the learner is having can be supervised by understanding and providing a learning environment.

Self instructional learning can be productive in the present environment. It lays the groundwork for helping shape the internal locus of control, on one hand. On the other hand, it leads to self pacing, wherein the learner can learn according to his own levels of comfort. Combined, the effect is that it reduces the anxiety levels in the individual and at the same time, keeps him involved, occupied and motivated. The computer tries to bring various pedagogical approaches into the world of self-paced learning, whose impact is based on the change in the mental expectancies of the learner [2]. So, any computer assisted learning, which is not perceived as a favourable envision by the learner becomes hard to sustain. This is particularly true for a self-instructional learning program, where one has to charter the learning course with limited in person guidance from a local educator.

The tablet devices and their software platforms have been duly designed for self instructional learning. With their increasing complexities and computational abilities, they are fast gaining recognition in the field of learning. Being lightweight, the physical strain in carrying them is greatly reduced and with typical screen sizes ranging from 7”-10”, they can be carried in person with ease.

According to a study, the top locations where people use tablet devices has been pointed out to be Couch (23.51%), Bed (16.54%) and Home (12.53%) [3], where the user tends to be more relaxed.

In a related study, it has been found, that the spreadsheet based apps for the tablets, though in their infancy are needed [4], and this can turn into a boon for educating the people. It has been argued, that simply increasing the technology available to the learner does not have a significant impact on education. It is the communication and interaction with it that has a long lasting impression [5]. Much of the present scenario in this direction does not address this problem. Using a spreadsheet like interface overcomes this handicap and allows for much more interaction, as the learner engages actively in the direct manipulation of objects [6]. Since formulas are calculated automatically, it helps the student learn the impact and the interrelatedness of the model very quickly. Graphs can also be used to visually present large information, which helps in its quick analysis and interpretation by the learner.

2. Motivation for Use-cases

The beauty of learning lies in the transfer of knowledge from the known to the unknown, from concrete to the abstract and from simple to complex. This can be achieved by making learning purposeful, transferrable and absorbing. Constructivist learning is a “learner-centric” approach, which utilises the past experiences the learner has accumulated, moulds them in the needed direction and integrates them with the present teachings. The individual tries and builds mental constructs during the exercise to gain an insight. Instructional Design pertains to creating instructional tools and content that helps in facilitating learning most effectively. It is based on the premise, that the teacher uses a certain strategy to teach, and the learner uses a certain strategy to learn. Learning is considered effective if these two strategies overlap. Instructional Design is an attempt in this direction so that the maximisation of learning takes place. It has been debated that innovative teaching methods make this more effective [7].

Learning at classrooms differs from e-learning, in the sense, that the lectures and activities are not directly reproducible and reusable by others. Since e-learning modules can be used again and again, Instructional Design ensures that the presented content rightfully explores its crucial concepts. Thus, the realisation of effective presentation of the content so that the learning needs of the user are served is of utmost importance.

2.1 ADDIE Model

It is a framework listing the generic process traditionally used in Instructional Design. Its five phases namely: Analysis, Design, Development, Implementation, and Evaluation constitute a guideline for building effective training tools [8] and define the outcome of the instructional materials. Figure 1 gives a pictorial representation of the model.

Figure 1: ADDIE Model

3. The Development Initiative

The use-cases have been constructed on a web based spreadsheet platform. Emphasis has been given on the features that would enable the learners to learn and interact in an easy, engaging and productive way [9].

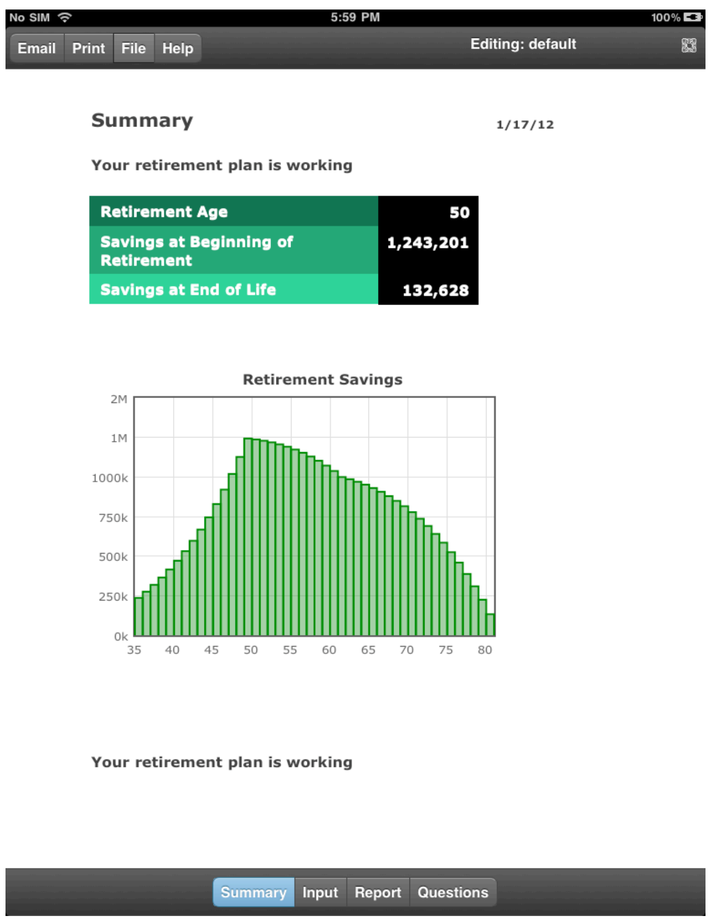


Figure 2: Retirement Planner using the Spreadsheet Platform

3.1 Analysis Phase

This phase involves delineating the main aim of the use-case, and establishes goals for educating the user and its desired behavioural outcome, that is, the pedagogical implications of the use-case are discussed. For example, The Financial Statements application highlights the financial accounting and book keeping process that needs to be maintained by an early stage enterprise user and a budding entrepreneur. The suite of enterprise web applications enables the large scale enterprises to integrate their complex business data, organize and edit key details, and access the information on both PCs and tablets. Charity Budget application help the individuals and foundations to plan and budget charitable donations, and share information with contributors, advisers and institutions. Valentine Cupcake application is a starting app for tertiary organizations to learn and share recipes for the Valentine Day.

Stock Value application helps the learner to understand the structure and workflow of financial valuation of a large scale publically traded organization through financial modelling and forecasting. The application has been designed on the iPad for teaching stock valuation using quantitative models in a simple, logical and an elegant manner.

The target audience of the use-case is identified and a certain level of prior knowledge and skill set on using spreadsheets and understanding the roles of the requisite business function is required. This helps in having a focussed effort towards imparting education. Other learning constraints are also analysed, like the interaction of the users with other people, objects, etc. in their immediate environment due to the mobile nature of the tablet. The method of user interaction is different on the tablet from the traditional laptops and desktops.

3.2 Design Phase

The applications have been made on a spreadsheet like interface, thus, no special skill is required. Moreover, a number of instructional videos have been prepared for use-cases, and are available on-line for free. They demonstrate the applications to the user. According to Miller, information has to be grouped into five to nine meaningful sequences [10]. Keeping this in mind, the different modules in the form of sheets have been restricted to six. The application is designed as a workbook of sheets. Brief descriptions are provided at the beginning, which give an overview of the application in a very concise form to the user. This is an important pre-instructional strategy which helps the user to store the framework of the lesson. This is important for enabling the user to learn, since the information is presented through the different sheets, which cover the different aspects of the entire application. We have initiated the ‘Export’ functionality, so the application data can be made interoperable with other spreadsheet formats. The data can be exported in a .csv, .pdf and .html format among others. ‘Import’ functionality has also been implemented, using which existing data can be imported into the application. At this juncture, data can be imported from almost all the spreadsheet formats directly or indirectly through a middleware spreadsheet format. This interaction between applications facilitates a collaborative approach towards learning.

A specific workflow for each use-case has been followed, so the user goes through the spreadsheets in a systematic way which helps him correlate the different sheets of the workbook with each other. As an example, “The Business Developer” application consists of the meeting agenda sheet followed by the price quote sheet, followed by the invoice sheets. The workflow of the application helps the learner not only understand a systematic way to conduct business practices but also brings him closer to the real business environment.

3.3 Development Phase

The applications have been developed on the cloud using the spreadsheet engine. They have been designed for the tablet keeping in mind the constraints and the usability issues that surround them. Mobile context, small screen size, and the edit and view modes of user interaction are some of them. The human interface guidelines are -

1. The font size has been kept reasonable from 9-10 points for the 7" tablets, and 11-12 points for the 10" tablets.
2. Same font type has been used throughout the use-case.
3. The use of the 'Bold' font has been minimized.
4. Adequate padding (4 pixels) has been used in the cells, so readability is easier. This also facilitates interaction with the user.
5. Effort has been made to keep the text as uniformly aligned as possible. The text portions have been left aligned, while the numerical cells have been right aligned.
6. Uniform colour scheme has been used as far as possible, and conforming to the intended user. For example, the color scheme of the "Holiday Budget" application has been designed keeping in sync with the festive mood of the target audience and is very different from that of a ticker valuation application, Stock Value, which has a steeper learning curve and requires more concentration on the user's side.
7. The right balance has been maintained for the borders of the particular cells, which successfully distinguish the cells from each other without overwhelming the user and maintaining an engaging user interface.
8. Alternate colouring of simultaneous rows has been done, to facilitate reading and entering the content.
9. The important fields have been created with a slightly larger font, so they are easily highlighted, for quick reference.

3.4 Implementation Phase

The use cases have been made available as tablet applications at a cost effective price in the different stores: iTunes store, Amazon Android Store, Google Play Store etc. making them accessible to all kinds of learners. The use-cases are manually tested to ensure that they are free from computational errors, as it is agreed by researchers that over 85% of evaluated spreadsheets contain errors [11].Then a test run is done manually on the intended device, and the application is checked against usability errors, which may include wrong formatting of the cells, missing borders etc. The metadata of the applications including but not limited to its description, logo, screenshots, support e-mail and links to external videos are added followed by uploading and submitting the application. This specific workflow ensures the quality of the content for consumption by a larger audience for a longer time period.

3.5 Evaluation Phase

We have a growing pool of user-reviews, and other statistics, which help understand the effectiveness of the described use-cases. Questionnaires are also being administered at the moment to gain further insights. Some reviews that were given to us:

On the Google Android Store, we received the following feedback for some our applications:

Home Budget: "Simple and to the point. Easy to fill out and understand…"

Invoice: "this is a very good app to start with especially when it comes to a small business. It definitely needs some upgrades. And overall function very good for a small business for independent it should be good to keep track of your friends and family in an organized fashion overall this is a very good app…"

Client List: "Very easy to manage and stay organized if you have or are starting a small business…."

A specific application has been considered below to further discuss the principles used by us towards developing an application.

3.6 The Financial Statements

The Financial Statements consists of 6 different sheets that cover the aspects of financial book keeping, which an enterprise needs to maintain. Education about these statements is essential for a business professional maintaining financial books of the company.

The application has been created for the small to mid-tier business owner, and for people who may be starting their own ventures. The basic knowledge about different kinds of revenues and expenses, assets and liabilities, financing and investing activities, etc. is a must know for the learner. Brief summary about the sheets has been included at the beginning. The application aims to educate the user about these different financial statements. The workbook has been designed in sync with its intended purpose.

Only the parts where the user is required to give an input have been made modifiable. The parts which are calculated automatically cannot be modified by the user. By changing the input parameters, the user can interact with the application, and see how the calculated values change, thus learning in the process. It follows a case-based approach to learning. The Word Cloud of application keywords and the screenshots have been included in the following figures.

Figure 4: Word Cloud of Cash Flow Statement

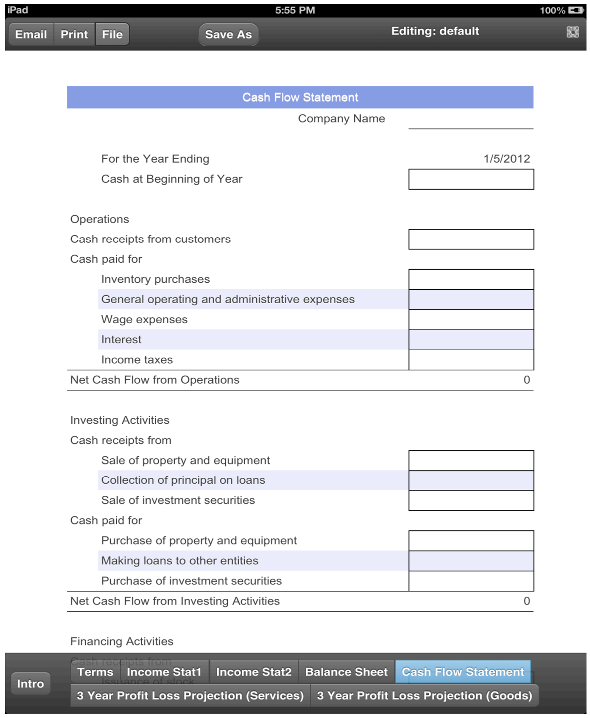
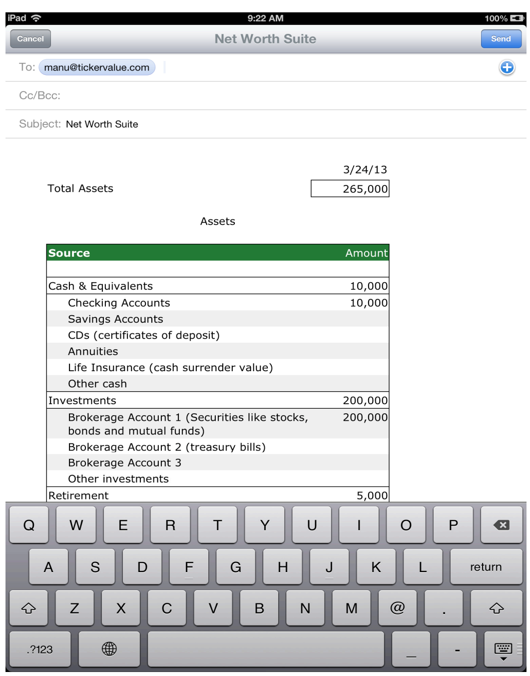


Figure 5: Cash Flow St. in The Financial Statements application

3.7 Financial Assessment Applications

Net Worth and Credit Card Payoff Calculator application have been designed on the iPad to enable a learner to understand and assess their personal savings and credit card debt, and set goals to improve their financial earnings.



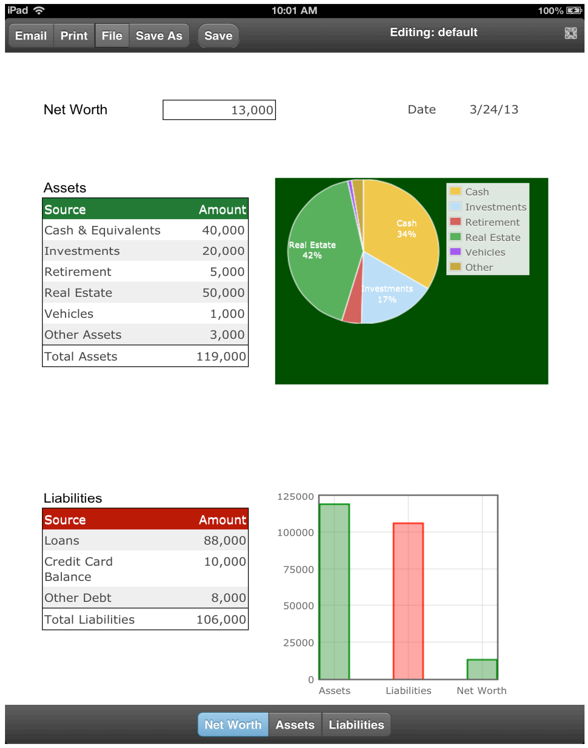


Figure 6: Net Worth application

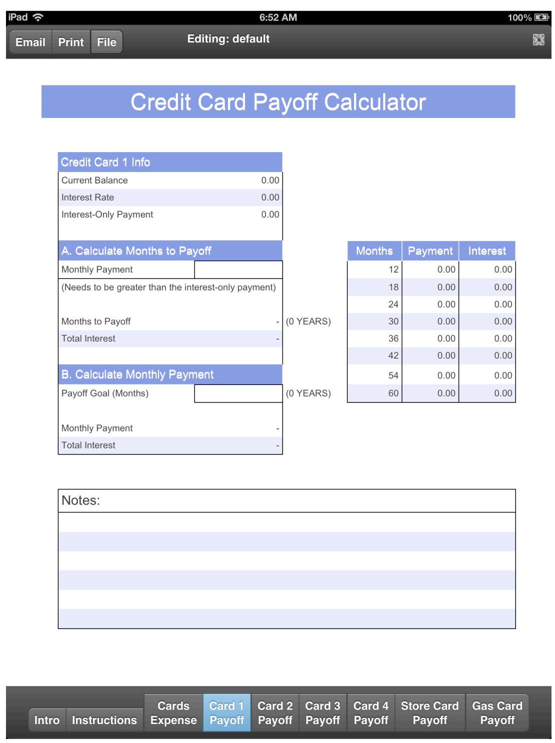


Figure 7: Credit Card Payoff Calculator

4. Future Work

Through this paper, we have shared a learning model, which uses tablets as a platform, and a spreadsheet based model for interaction. The merits of this model have been explained, with a specific application. The use-cases have been developed for the English speaking user groups. The model can be easily expanded and used at a larger level to educate more target groups. It can be used at classrooms for teaching students, or educating and motivating people about their health, with the help of interactive applications. Work is being done in this regard at Aspiring Investments Corporation. Since, the model is based out of a cloud enabled spreadsheet it can also be used to foster collaborative learning at a larger scale. We are also building upon the interoperability of the spreadsheet data with other popular data formats.

5. Conclusion

Tablets are portable and handy tools, which have claimed their place in the post PC device segment category. Their mobility allows the user the freedom to interact with them on the go. Through this paper, we have envisioned spreadsheet based use-cases, which are helpful in imparting knowledge to learners. Following the principles of Constructionism, and embedding a set of Instructional Design practices, these self-learning applications allow mass emanation of knowledge in an engaging manner. These principles and methods can be applied to help achieve the learning objectives in a variety of environments.

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iPodia: Borderless Interactive Learning

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Abstract

The 21st century higher education is rapidly evolving towards a vastly different shape influenced by the global trends of industrialization of institutions, increase of education supply, underwater college degree, and student's changing demands of learning. This paper introduces a new "Classrooms-Without-Borders" paradigm of global education, called iPodia, which aims to support borderless interactive learning. The iPodia pedagogy features with "inverted", "interactive", and "international" learning to enable students around the world to learn with, and from, each other collaboratively as cohorts in a virtual classroom. The iPodia Alliance, which was established in 2012 as an independent global consortium among nine leading higher education institutions, enables various iPodia courses to be collaboratively developed and jointly offered by multiple iPodia university partners. Unlike the current distance education approach where IT is used to enlarge the delivery distance from teachers to students, iPodia demonstrates a no-distance education model where IT is employed to eliminate the learning distance between students in remote classrooms. Based on the flipped classroom model, iPodia and MOOC can provide students with the best combination of educational resources, because they can both learn subject contents from the best global teachers (i.e., via MOOC) and develop subject contexts with the best global peers (i.e., via iPodia).

1. Introduction

Yes, the world is becoming flat, as Thomas Friedman suggested [1]. However, we believe that until the world of learning becomes flat, the world cannot be true flat! The rapid advancements of globalization and technology over the past few decades have significantly changed the landscape of higher education in the 21st century, leading to many new learning possibilities beyond what we know of to date. The traditional teaching/learning paradigm that mainly focuses on content lectures is now being greatly challenged by the sweeping MOOC (i.e., massive open online course) movement which makes content courses available to all learners free of charges. All learning institutions, which draw tuitions from students by offering classroom lectures on campus, must now find a new value proposition to sustain their campus education. In the global context, every leading university encounters similar challenges and opportunities: how to create new values beyond traditional lectures for on-campus learning, how to overcome the paradox posed by the tension between global demands and local constraints, and how to deliver high-quality global education right from one's local campus? Rather than engaging in a "red-ocean" price-competition with distance education, which will drive everyone to the bottom, we believe that all learning institutions should employ a "blue-ocean" strategy to focus on the "no-distance education" that features borderless interactive learning across physical, institutional, and cultural boundaries.

This paper introduces our efforts over the past five years to develop a new "no-distance education" model as a blue-ocean innovation strategy to address the current challenges of higher education. iPodia, where the letter "i" stands for "inverted", "interactive", and "international" learning, and the word "podia" is the plural of podium, is developed based on three pedagogical hypotheses: (1) contextual understanding can be achieved by learner interactions - hence the "inverted" learning, (2) what you learn depends on with whom you learn - hence the "interactive" learning, and (3) diversity can increase the learning opportunity for everyone - hence the "international" learning. Based on this iPodia pedagogy, an independent global consortium among 9 global leading universities, called the iPodia Alliance, has been established to promote a fundamental transition from the current distance education to the future "no-distance" learning. Unlike MOOC which mainly focuses on content lectures with enhanced teacher-to-student interactions, iPodia enables high-fidelity and peer-to-peer interactive learning to achieve contextual understanding. As most lecture courses become free and many college degrees are underwater today, iPodia can become a new value proposition of campus education for 21st century universities.

The rest of this paper is organized as follows. Section 2 elaborates some global trends of higher education and explains why the no-distance education is a blue ocean innovation strategy for leading universities. Section 3 introduces a successful example of no distance education – iPodia in regards to its pedagogical foundations and practical applications. Section 4 summarizes our lessons learned to date and foregrounds potential developments in the future.

2. Global Trends of Higher Education

There are four global trends that are impacting the future of higher education: (1) the learning institutions have been experiencing a mass industrialization process; (2) the ubiquitous application of technologies leads to an increasing supply of free lecture courses; (3) the world economic recession causes many college degrees to dive underwater; and (4) there emerges new demands towards campus education from student's perspective.

Looking back in history, a 19th century university was a place for a few top scholars (the masters) to create new thoughts that led the development of humanity and society and form them to nurture the few elites (the pupils) closely and continuously. Whereas, a 20th century university has become a very different place where many professors do their specific R&D projects to satisfy market needs (i.e., very much like a development company) and to lecture many students in large classrooms for university degrees (i.e., similar to a certification bureau). What has happened in the last century is that universities have gone through a fundamental transformation in which a strict standardization and mass industrialization process took place in order to serve the many and save the money. When industrial models, criteria, practices, and management structures are applied to universities, the key stakeholders and activities that exist on university campuses become quite similar to their counterparts which occur inside a factory. In a sense, a university campus today operates much like a mass production factory, where different standard products are being produced via routine production processes. After students (i.e., raw materials) are admitted into a college (i.e., a factory) through a competitive selection process, they are guided (i.e., produced) by teachers (i.e., factory workers) to acquire certain knowledge (i.e., product functions) by taking courses (i.e., production process) each semester. Depending on the specific degree requirements (i.e., projected market demands), a core curriculum (i.e., a predetermined assembly process) must be followed strictly to constitute an area of specialization. The examinations of student's competitiveness in courses become the quality control steps taken for each production step as a way to judge their preparedness and readiness in the job market (i.e., selling prices of a product on the market).

The above analogy between current university and modern factory, even though a bit cynical, goes beyond just stakeholders and activities. In fact, many of the present eLearning efforts that are taking place in university campuses are quite analogous, in both sprite and implementation, to the industrial automation movement that occurred in many factories in the last century. During the 80s and 90s, under the goal of serving the many and save the money, many factory owners adopted computer technologies (e.g., CAD, CAE, robots) to automate existing factory operations with the hope to boost productivity, reduce costs, improve quality, and increase profits. Only after huge initial investments led to disappointing outcomes, they started to understand that using technologies to automate existing products without updating/improving production process is not a viablestrategy to win market competitions. Interestingly, the same thinking happened, and hence the same lesson can apply, to universities here. In the late 90s, driven by the same goal of serving the many and saving the money, many learning organizations ported their classroom courses for online delivery to distance students. New eLearning technologies are used to automate the classroom lectures based on the same old pedagogy - similar to early factory efforts in using technologies to automate the product (i.e., lectures) without improving the process (i.e., pedagogy). The lesson from factory here is quite obvious for university, that automating courseware with new technology without developing new pedagogy is not a viable strategy.

Since most universities now operate like product factories, let us now use some very basic principles that govern the supply-demand decisions on competitive markets to examine what has happened (or will happen) to universities. From the supply viewpoint, the rapid development of eLearning technologies in the past few decades has dramatically increased the education supply. Every time a new technology (i.e., radio in the 50s, TV in the 60s, satellite in the 70s, Internet in the 90s, mobile technology in the 2000s and eventually cloud computing in the 2010s) is applied, the education supply (e.g., courseware) in terms of speed, distance, and scale is drastically increased. As a consequence of more and cheaper education supply, free high quality courses are becoming a reality and widely available to all. The recent popularity of the MOOC movement that features flexible scalability and open access is the best demonstration of such a trend on the supply side. It should be noted, however, the vast majority of these increased education supplies to date have focused on the same type of learning demand – how to deliver content lectures to the many in the most timely and cost effective manner. In other words, the pedagogy behind these e-courseware remains mostly unchanged despite of the impressive developments of technology enhanced learning.

While the supply side is enjoying a vast expansion, the demand side of higher education is experiencing a series stagnation as an ensuing consequence (or a chain reaction) of the housing bubble, financial crisis, economic recession, and global depression. The rapidly shrinking job opportunities and increasing college tuitions lead to a major financial crisis in student loans. This so-called "higher education bubble" is drawing increasing attentions in recent years. As an example, Figure 1 illustrates a comparison of annual increase rate between college tuition, medical care, home price, and consumer price index (CPI) from 1978 to 2011. It is clear that the increase of education price significantly outpaced the rest even including the recently busted housing bubble. Such a dramatic increase of price together with a rapid shrinking of middle class worldwide leave college students no choice but to increase their student loans respectively. As a matter of fact, the national student loan debt has almost tripled during the past eight years. On the other hand, nevertheless, the increase of job opportunity could not match the increase of education price partially due to the global depression and partially because of the insufficient education system itself. Such an unbalanced development trend inevitably results in the "underwater" college degrees. This is to say that, unlike before, a college graduate with a degree certification is often unable to find a satisfactory job that pays off his or her education debt in a short period of time. The fact that the unemployment rate of new college graduates remains at a high level is the best evidence of this trend [2].

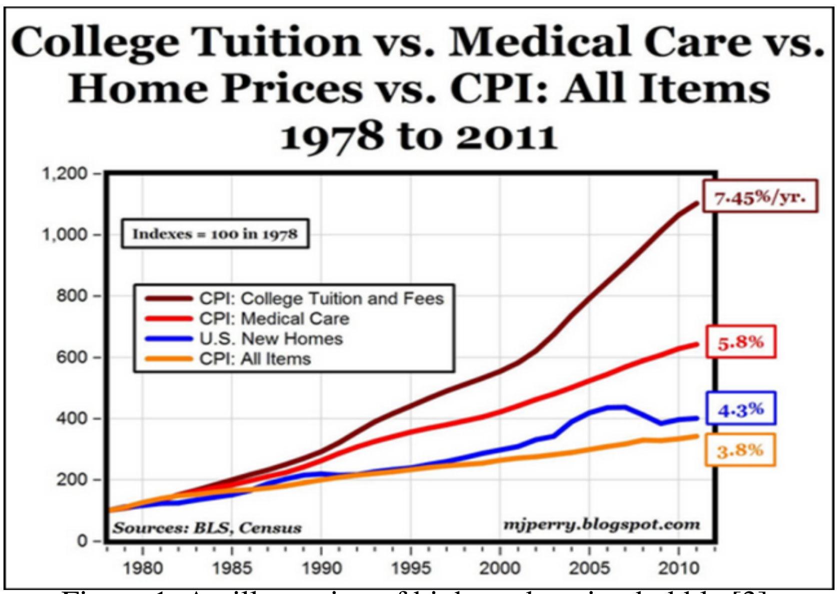

Figure 1. An illustration of higher education bubble [3]

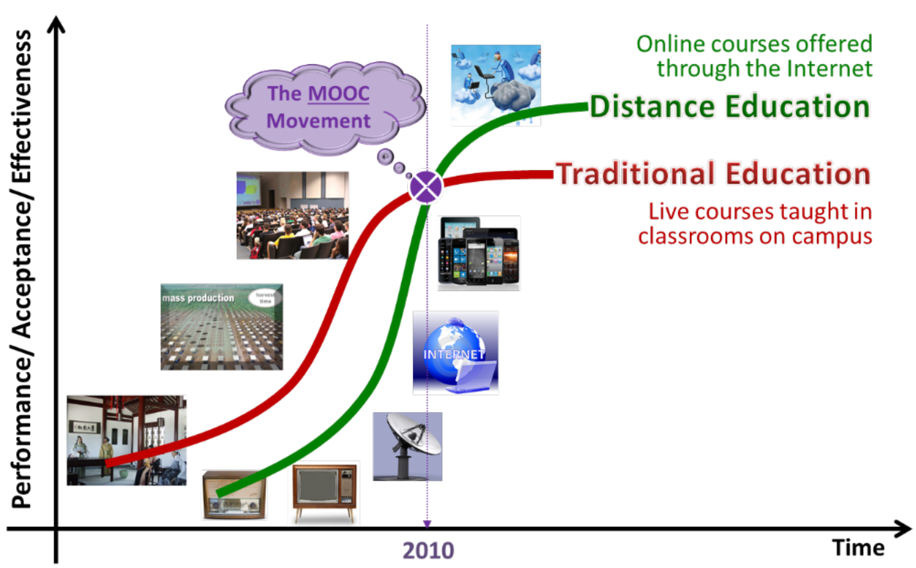

Figure 2. S-curves of traditional education and digital education

The increasing supply and decreasing demand together leads to an interesting question: will digital education be the saver (or a silver-bullet) of future higher education? Figures 2 illustrates the S-curves of traditional education and distance education. As the market of traditional education (the red curve) shows clear signs of being saturated, the digital education (the green curve) is gradually accumulating more momentums in the meantime. Many people believe that the arising MOOC movement is exactly the strategic inflection point [4] where the digital education S-curve will penetrate that of the traditional education. In that scenario, all leading universities encounter similar challenges: how to sustain itself in the sweeping trend of MOOC movement and how to transform its on-campus learning activities to meet new market demands?

To win market competitions, a better strategy is always to create a blue ocean of new demands rather than competing in prices with other suppliers in a red ocean based on existing demands [5]. In the realm of higher education, the red ocean refers to the conventional teaching/learning paradigm, in which a student learns content knowledge from teachers on a college campus via individually attending passive lectures [6]. We believe that one possible blue ocean strategy lies in the new paradigm of no-distance education, in which students develop unique contextual understandings from interacting with their peer classmates in the virtual classroom via collaboratively accomplishing team exercises and tasks. Instead of competing with traditional education and digital education in the red ocean, we argue that a learning institution should invest in developing the no-distance education capabilities to boost the borderless interactive learning opportunities for their students across physical, institutional, and cultural boundaries. Compared to the traditional education and conventional digital education which both focus on creating a resource or a space to attract others to come to learn, the unique values of no-distance education lie in the intercultural peer-to-peer interactions within a shared global context.

3. An Example of No-Distance Education - iPodia: Borderless Interactive Learning

3.1 iPodia Pedagogy

This section introduces a successful example of the no-distance education model - iPodia, where the "i" stands for "inverted", "interactive", and "international" learning. The fundamental pillar of iPodia is its innovative pedagogy developed based on three basic hypotheses about effective learning: (1) contextual understanding is best achieved via student interactions - hence the "inverted" learning, (2) what you learn depends on with whom you learn - hence the "interactive" learning, and (3) diversity can increase learning opportunity for all - hence the "international" learning.

In regards to the first hypothesis, context is what one uses to make sense of content while learning and practicing. Unlike content, which can be taught by teachers with lectures, contextual understanding is co-constructed when learners (i.e. teachers and students) engage with each other over time. In a conventional learning processes, students sit through lectures on content and are then asked to exercise problem solving at home and left to develop contextual knowledge by themselves. iPodia inverts the traditional schoolwork and homework process by having students first watch online lectures at home to learn subject content before attending classes to engage in various collaborative activities with their classmates to develop contextual understanding (see Figure 3). iPodia employs this inverted learning process to support the first hypothesis, thereby creating a new value proposition for campus education, turning away from content-based lectures and towards nurturing context for more effective education. Inverted learning (or flip teaching) is a simple idea that has profound implications. The idea of “flip teaching” (or “flipped classroom”) is not completely foreign to the education community [7]. But only until recently is it drawing more attentions than ever before due to the increasing popularity of MOOC movement. In the past, relatively few research efforts have been devoted to investigate its impacts on student’s learning effectiveness especially in specific to no-distance education in a cross-cultural environment.

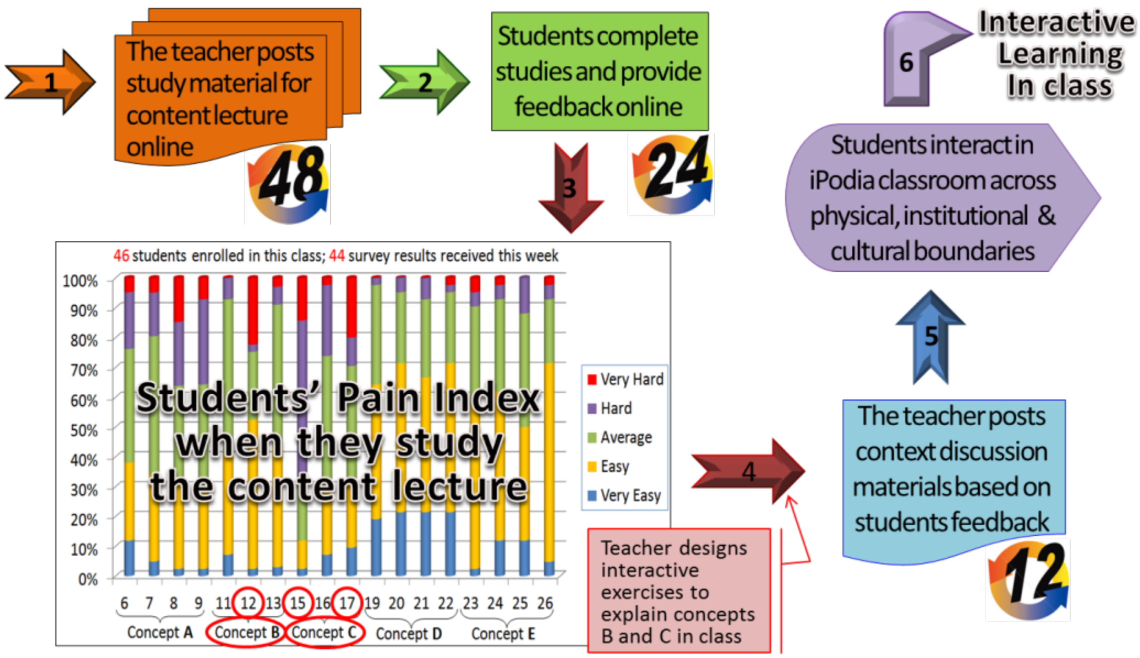

Figure 3. A typical “inverted learning” process in iPodia classes

The second hypothesis is a corollary of the first one, and states that subject content can be learned "from" teachers (or textbooks) but contextual understanding is best developed "with" peers. Thus, the kind of context students can learn from depends on, to a large degree, the peers with whom they are studying with. The inverted learning process explained above transforms the learning paradigm from passive (i.e., be lectured at) to interactive (i.e., to participate in). By turning the "learning-from" pedagogy into a "learning-with" pedagogy, iPodia takes the active learning approach [8] one step further by emphasizing the interactive learning. iPodia enables interactive learning across geographical, institutional, and cultural boundaries, thereby overcoming the strategic irony of global experience versus local value for institutions of higher education. The unique values of interactions in the educational process have long been recognized and elaborated by many past studies [9]. According to Anderson’s extension [10] of Moore’s traditional classification of interactions [11], there exist six types of important educational interactions: student-teacher interaction, student-content interaction, teacher-content interaction, student-student interaction, teacher-teacher interaction, and content-content interaction. Compared to the traditional learning paradigm that mainly focuses on student-teacher and student-content interactions, iPodia also highlights the importance of student-student and teacher-content interactions. On one hand, various class activities (e.g., case study, cross-cultural exercise, class debate, etc.) are intentionally designed to encourage and facilitate iPodia students to acquire the unique contextual understandings by means of interacting with their peer classmates. On the other hand, iPodia instructors are also required to constantly modify their lecture content (e.g., presentation slides) based on the most updated feedback from students during the “inverted learning” process (see step 4 in Figure 3).

The third hypothesis is built upon the second one, because if “what students learn depends on with whom they learn”, then it is reasonable to hypothesize that student’s learning opportunity will be increased when they study with a diverse group of learners from different social and cultural backgrounds. Beyond the traditional inter-disciplinary focus, iPodia further expands to the inter-cultural learning by linking multiple interactive classrooms located in different countries and cultural regions around the world. This new international dimension enables all iPodia students to interact with, and learn from, global classmates right from their own campus. Global education should lead to a mutually deepened understanding of global culture. International students who pursue degrees on foreign campuses are often overwhelmed by the local culture, and can therefore be ineffective in engaging in balanced cultural exchanges that benefit their local classmates. It is difficult to develop meaningful cultural insights through short-term overseas studies, and time away presents challenges for returning students re-entering their regular curriculum. In light of the widely held belief that global travel is necessary for globalization, the question then becomes: is there a better model for future students to enjoy global higher education without leaving home? iPodia uses the high-bandwidth Internet connectivity and existing video-conferencing technology to bring teachers and learners around the world together in the same virtual classroom: it enables teachers to instruct together via joint lectures, and learners to study together via direct interactions.

iPodia opens many isolated and repeated classrooms among multiple institutions. This is, in both concept and spirit, a "Classrooms-Without-Borders" paradigm. iPodia changes the current higher education systems in at least two fundamental ways. First, by polling multiple remote classrooms and separate instructors together, it transforms the present-day ecosystem of university from the "vertical integration of doing everything in house under one roof" to a horizontally coordinated paradigm much like the "foundry" model that revolutionized the semi-conductor industry. Second, by collocating learners from multiple institutions with diverse cultural and social backgrounds to form collaborative learning cohorts, it uplifts the downward proposition of today's university from the serial lectures of knowledge contents by a few teachers locally to a cyclic co-construction of knowledge contexts, as well as mutual understanding of each other, among many students globally.

3.2 iPodia Alliance

Based on the above iPodia pedagogy, University of Southern California initiated the iPodia Alliance in 2012 as an independent, not-for-profit, global consortium among leading universities to promote the new "classrooms-without-borders" paradigm for the 21st century higher education. All collaborating iPodia institutions retain their independent identities, degree programs, and curriculum requirements; and work together strategically to develop new courseware and deliver joint classes via the Internet-based iPodia platform to address important socio-technical subjects and significant global challenges. The seven initial founding members of the iPodia Alliance include:

- University of Southern California (USC) in Los Angeles, USA
- Peking University (PKU) in Beijing, China
- National Taiwan University (NTU) in Taipei, Taiwan
- Korea Advanced Institute of Science and Technology (KAIST) in Daejeon, S. Korea
- Israel Institute of Technology (Technion) in Haifa, Israel
- RWTH Aachen University (AACHEN) in Aachen, German
- India Institute of Technology - Bombay (IIT) in Mumbai, India

USC, through its Viterbi iPodia (ViP) Program Office, serves as the iPodia Alliance' current administrator to coordinate academic and administrative affairs among members. The Escola Politécnica da Universidade de São Paulo (EPUSP) in São Paulo, Brazil and the Birla Institute of Technology & Science, Pilani - Hyderabad in India joined the iPodia Alliance in 2013 as the 8th and 9th members. A few more elite institutions in other major world cultural regions, such as the Middle East, Africa, Russia, etc., are being invited to join the iPodia Alliance to enrich transcultural learning opportunities for all. In addition to the resulted cultural diversity, a developed iPodia Alliance is also an important precondition to break the limitation of different time zones on the no-distance education paradigm. Unlike the traditional distance education, the iPodia classes feature with synchronized interactions between students located in different places on the world. We believe that the physical distance can be eliminated by the advance of IT, whereas the time zone difference can be addressed by the participation of more institutions, the offering of more courses, and eventually a fully connected global curriculum network. The long term goal of iPodia Alliance is to include at least one world leading institution in every time zone, so that whenever a student walks into an iPodia interactive classroom in his or her own university campus, there is always a synchronized class with different classmates in different time zones and diverse cultural regions awaiting for him or her to join. For instance, in an existing iPodia course namely “Principles and Practice of Global Innovations” which is jointly offered by USC, KAIST, PKU, Technion, and AACHEN in the 2013 spring semester, American students located in the USC campus are able to learn together with German and Israelite students in the morning but with Chinese and Korean students in the evening of the same day.

There are three principles that govern the operations of the iPodia Alliance. First, the "equal-reciprocity" principle encourages members to strive for balance between iPodia courses offered to and received from the Alliance within a certain period. This ensures that the benefits of equal contribution can be shared among all participating members. Second, the "revenue-neutral" principle holds that members are responsible for the costs incurred by their participation in all activities, and no money (e.g., tuitions, etc.) will change hands between any Alliance members. This promotes a not-for-profit culture, which will allow Alliance members to focus on collaborative win-win contributions. Finally, the "not-joint-degree" principle states that the Alliance's main goal is to share courseware development and collaborate on course delivery, rather than to create joint degrees among its member universities. This enables all Alliance members to maintain the independence and uniqueness of their curricula, which form the basis for their valuable contributions to the Alliance.

3.3 iPodia Technology

Different technologies, such as learning management systems, video-conferencing, web-conferencing, mobile messaging services, and social networking services, are employed as means to realize the iPodia pedagogy. Note that, unlike the distance education in which technology functions to enlarge the delivery distance of content knowledge from teachers to students, iPodia which is a no-distance education paradigm relies on technologies to eliminate the physical distance between students in located in different campuses. Figure 4 presents a typical iPodia interactive classroom that is located in the USC campus. Table 1 summarizes various technologies used in a typical iPodia class.

Figure 4. Illustration of a typical iPodia interactive classroom

Table 1. Summary of technology enhanced learning in iPodia

Pedagogy Hypothesis	Objectives ("End")	Technologies ("Means")
Interactive learning	Student-teacher	Video-conferencing and web-conferencing
	Student-content	Learning management system
	Student-student	Web-conferencing, mobile messaging, social networking
	Teacher-teacher	Web-conferencing
	Teacher-content	Learning management system
Inverted learning	Flip teaching	Learning management system
International learning	Class level	Video-conferencing
	Team Level	Web-conferencing
	Individual level	Mobile messaging and social networking

3.4 iPodia and MOOC

The best innovation is a simple solution that addresses a critical problem to yield large impacts. iPodia is not the same as, but fully complementary to, the recent MOOC movement in the online education world. MOOC is a scale-up of the existing distance education model that puts subject contents online openly and freely for students to learn from the cyberspace. iPodia, in comparison, is a new no-distance education paradigm that provides borderless interactive learning opportunities for students to learn subject contexts with each other via the cyberspace. While different in their pedagogical foundations, MOOC and iPodia are complementary to each other in education practice as the flipped classroom (or called inverted learning in iPodia) approach becomes increasingly popular nowadays. With the flipped classroom approach, students can study the best online course contents offered by MOOC at home before coming to the iPodia interactive classroom on campus to collaboratively engage in interactive exercises to develop contextual understandings with classmates, as well as mutual understanding of each other, across physical, institutional and cultural boundaries. Together with MOOC, iPodia provides students with the best combination in the education world because they can both learn subject contents from the best global teachers and develop subject contexts with the best global peers.

4. Conclusion

The 21st century higher education is rapidly evolving towards a vastly different shape influenced by the global trends of mass industrialization of institutions, increase of education supply, underwater college degree, and student's changing demands towards campus education. Rather than competing with distance education in a read ocean, we believe that leading universities should shift their strategic focus to create a blue ocean of no-distance education. This paper introduces some of our efforts to substantiate the "no distance education" - iPodia. The iPodia pedagogy features with the "inverted", "interactive" and "international" learning. The iPodia alliance is an independent global consortium among leading universities, upon which various iPodia courses are collaboratively developed and jointly offered by multiple iPodia partners. To date, over 250 students from 6 different countries and regions of the world have taken different iPodia courses. Our future works include some rigorous researches that are conducted upon the iPodia platform. For example, the work in process projects include an formal assessment of student's learning effectiveness in iPodia classes, an investigation of iPodia impacts on student's preparedness working in global workforces, a study of student's behaviors working in multicultural virtual teams, a comparison of ideation effectiveness between monocultural collocated teams with multicultural virtual teams.

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Rethinking Learning

Applying and comparing the learning outcome of new teaching and learning strategies at both a university and a business (University of Alexandria, Egypt and Telecom Egypt).

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Abstract

We will be carrying out a comparative study of learning outcome between students enrolled in the University of Alexandria, Egypt and staff working at Telecom Egypt. Changes in technology over the past few years have removed a number of physical and economic barriers for those living in Egypt and wishing to pursue a university education or improve the workplace skills. However, the advancements in technology are not what stimulated this project. The challenge to improving learning isn't with technology; it's the learning strategies that are being applied. Business has typically adopted the teaching and learning strategies of educational institutions.

For the study we will be using a new teaching and learning strategy D4LP (Design for Learner Performance), developed in Canada (RethinkingLearning.com) and first piloted in two major universities in Thailand in 2008 (Ubon Ratchathani University and Sukhothai Thammathirat Open University). D4LP is designed to go well beyond conventional teaching and training methods with the potential to directly influence change in learners and impact business. D4LP has an innovative 'learning environment' designed to challenge and motivate a learner to engage in constructing their own understanding of new knowledge. This result in higher levels of learner participation, learner confidence and learning outcome, plus, promotes the development of critical thinking, interpersonal and knowledge comprehension skills. D4LP allows us to design our teaching and training strategies, implement these strategies, and assess the learning outcome of these strategies. In addition, D4LP allows us to diagnose the flaws in project design and learner effort towards mastering a specific skill.

The challenge we face is not the learners' ability to embrace D4LP strategy; the challenge will be in restructuring the role of program committees, course instructors and training designers. In order for learner engagement to have a direct impact on learning outcome, teaching and learning strategies need to go well beyond conventional methods. We have to throw off the belief that the only way for a learner to learn new information is to present it to them in the form of a lecture.

The guiding factors that inhibit change for the University of Alexandria and Telecom Egypt:

- *The teaching success of any university in Egypt is measured by the **quantity** of students they accept and not the **quality** of students they graduate.*
- *An instructor is assessed on the **quality** of their lecture and not the **quality** of students' learning.*
- *Business training is influenced by academic teaching strategies.*
- *Both institutions are still applying traditional teaching and training strategies that mainly promote the memorization of facts and procedures.*

Rethinking learning

Applying and comparing the learning outcome of new teaching and learning strategies at both a university and a business (University of Alexandria, Egypt and Telecom Egypt).

Leslie Richards Ph.D. and Cherine Sallam (Ph.D. candidate)

1. Introduction: "the challenge"

The rethinking learning project is to encourage instructors and university administrators to re-think their teaching strategies. The thinking that individuals are unable to advance beyond their 'predicted' academic abilities is being questioned. As lecturing is central to the teaching philosophy of the majority of instructors, asking them to re-assess their applied teaching philosophy and carry out an in-depth appraisal on the impact their lectures have on changing learning outcome is not an easy task. For some instructors to appreciate the benefits of change, they need to experience it for themselves.

"When I was first exposed to the T5model [basis of Rethinking Learning], I felt that I was being led along a path that was quite different from my initial goal. I was forced to examine my teaching at a very fundamental level, essentially dealing with the philosophy of teaching and the underlying principles of learning. This lead to some initial irritation and resistance on my part as I felt my established classroom teaching methods (which until now had been moderately successful) were being threatened. After the first learning design session, I began to overcome my own resistance and initial aversion. I was able to look at the creative potential of adopting the T5 methodology to core engineering courses. I expect these insights to lead to better learning opportunities for my future students." Rob MacDonnell, Faculty of Engineering, University of Waterloo, Canada (2000).

The challenge we will face is not learners' ability to embrace change; the challenge will be in restructuring the role of program committees, course instructors and training designers. For learner engagement to directly impact learning outcome, teaching and learning strategies need to go well beyond conventional methods. You have to throw off the belief that the only way for a learner to learn new information is to present it to them in the form of a lecture. Transforming how institutions implement their teaching and learning strategies is difficult but not an unattainable task however, it will require the community to engage in the process of re-thinking how learning happens. The challenge then is for teaching to focus on student learning rather than on content delivery

2. C- in C- out

"It is no surprise when an A+ student walks out the doors as an A+ graduate. But what about a B student who finishes with an A, his or her programs would have a higher added value than the programs at the top university." OECD (2010)

Traditionally, students' university entrance GPA (Grade Point Average) reflects their learning outcome potential as university students. This argument is based on the assumption that a learner's entire educational experience is founded on a teaching strategy of content delivery rather than student learning and; that learners more suited to memorization of facts and concepts are more likely to succeed and keep on succeeding. "The GPA (Grade Point Average) is a testament of what you [students who are applying to a university] are capable of" (Jeanette Leach, 2009).

Most universities don't enjoy the same advantage as universities that are able to set a high GPA entrance requirement (B+ to A) to their programs. Universities with a high (GPA) entrance requirement are virtually assured that their students will have the ability to succeed in mastering a university lecture-centred teaching and learning system and will graduate with the same (B+ to A).

2. 1 No change

To verify the anticipated outcome of this statement, ideally, universities would need to monitor students' input and output GPA averages, to ensure that no discrepancies exist between the ability of the entrance students and the quality of the university's academic programs. The registrar of a leading Canadian university stated that, "Universities do not create and maintain data that would allow one to analyze students' entrance averages versus their graduation averages. Some universities do however, implement a 'predicted GPA', derived from students' entrance GPA that although traditionally lower, ultimately equates to their graduation GPA. Therefore, we can only assume that maintaining a student's entrance GPA is the standard that most universities aim for, or are capable of, and no more.

Ubon Ratchathani University (UBU), located in the North-East of Thailand maintains a database (by program) of all students' entrance and graduation GPA. The combined average for all programs over a four year period (2005-2008), shows no significant difference between students' entrance and graduation GPA (with a standard deviation of -0.0036 GPA on a four point scale).

At UBU, instructors have successfully navigated their lecture-centered education. Therefore, it may appear reasonable for these instructors to assume that if they were able to learn within the traditional lecture-centered method, their students should also be able to learn by this method as well. However, the entrance GPA of UBU students is considerably lower than that of their instructors' undergraduate university entrance GPA, therefore, unlike their instructors, the majority of UBU undergraduate students are not absorbing, remembering and recalling the large volume of information being transmitted to them via lectures. Subsequently, if learning does not happen, instructors tend to fault the lack of positive learning outcome on the students.

3. Creating teaching and learning alternatives

"People and organizations everywhere can see that current systems of education are failing to meet the challenges we now all face and they're working furiously to create alternatives" Sir Ken Robinson (2006)

In an attempt to rectify poor learning outcome, University of Alexandria, as well as other universities internationally, will replicate lecture-centred instruction in a variety of media to provide students with additional access to lecture content outside the classroom. Although this generates little or no change in actual learning outcome, it does support traditional teaching and learning methodology. Barr and Tagg (1995) point out that "An instructor is typically evaluated by her peers or dean on the basis of whether her lectures are organized, whether she covers the appropriate material and, whether she shows interest in and understanding of her subject matter….They do not raise the issue of whether students are learning, let alone demand evidence of learning…Many institutions construe teaching almost entirely in terms of lecturing."

Over the years, instructors have viewed the problem of poor learning outcome as learning challenges. The 'T5' Model, Salter, Richards & Carey (2004) talks about instructional challenges: "Students do not prepare for class time; No time to cover topics in depth; No time for discussion in class; Difficulty providing feedback to individual students in large classes; Students do poorly on tests/assignments...". When we focus on instructional challenges rather than learning challenges it provides a totally different perspective on the root of the problems associated with students' learning. Learning problems no longer point to the learner but to the teaching and learning strategies, the primary strategy being the lecture. Continuing to lecture or replicate the lecture in various forms of media only masks the learning problem and interferes with students' ability to advance beyond their university entrance GPA. By moving away from the lecture-centred method and all its inherent instructional challenges, to a process that allows students to develop their own learning strategies, students are more motivated and build confidence in their ability to learn.

University of Alexandria offers excellent academic programs with highly qualified instructors who are dedicated to the improvement of learning and the quality and abilities of the students who graduate from their programs. However, improving or matching the graduation GPA of universities that pre-select students based on their high entrance GPA appears to be impossible within the established teaching and learning strategies at UA. Like other universities, UA has held the position that the lecture-centred method is central to learning. If the lecture-centred method of teaching impedes the possibility of improving students' learning outcome, the challenge for UA is to make a radical change in their teaching and learning methodology.

4. Rethinking learning

"Contemporary learning theory is based upon the notion that learning is an active process of constructing knowledge rather than acquiring knowledge….rather than a process of knowledge transmission." Duffy & Cunningham (1996).

In order to begin to move away from their traditional teaching and learning strategies, that promote the memorization of facts, the University of Alexandria and Telecom Egypt (TE) were presented with a new learning design model. Design for Learner Performance (D4LP), was introduced to their program committees and training directors. The D4LP model emphasizes "*Tasks* (learning tasks with deliverables and feedback), *Tools* (for students to produce the deliverables associated with the tasks), *Tutorials* (online support/feedback for the tasks integrated with the tasks), *Topics* (content resources to support the activities) and *Teamwork* (role definitions and online support for collaborative work)", (Salter, Richards & Carey, 2004).

Collaboration as well as learners taking responsibility for their own learning is central to the D4LP method of transferring the responsibility for the learner gaining knowledge and skills *from* the instructor directly *to* the learner. The D4LP learning and training strategy is designed to go well beyond conventional training methods. D4LP incorporates tasks, tools, tutorials, topics and teamwork to achieve ongoing student engagement, ongoing constructive feedback, ongoing collaboration and ongoing measurement of learning outcome. Supportive learning environments motivate students by engaging them in higher level applications where they are asked to apply, analyze, evaluate or create, relative to defined course learning outcomes. The additional foundational knowledge (required in order to master the primary application) is acquired by the student on a need-to-know basis, or introduced by the instructor through feedback.

5. Learning environments to guide mastery of learning outcomes:

A learning task is an activity that requires students to engage with course materials. “Learning tasks pose an open question; students respond by engaging with course material. The single most important factor shaping learning outcomes is the way in which students approach a learning task …” (Jackson & Anagnostopoulou, 2001).

At the core of D4LP is an innovative ‘learning environment’ that consists of a single open question that requires the learner to solve a practical problem. This open question challenges and motivates learners to engage in learning that builds their confidence and enables them to independently and collaboratively construct meaning in their learning. This results in higher levels of student participation and learning outcome.

6. Flipping Bloom's Taxonomy:

According to Bloom’s Taxonomy (1956), “The traditional learning paradigm implies a fixed order; before a learner can advance to higher order thinking, like applying, analyzing, evaluating or creating; they first need a solid understanding of fundamentals or a solid foundational knowledge.” In comparison to this traditional learning paradigm, with the D4LP method, foundational knowledge is specified by the instructor as part of the criteria or conditions required in order for students to master a task. The instructor designs tasks that challenge the students in applying, analyzing, evaluating or creating. This introduces entry level students to higher order thinking at an early stage and helps them to maintain their understanding and memory of foundational knowledge. As students move into advanced courses, they are better prepared to move directly into advanced applications. As Brownstein (2001) indicates, “Learners should constantly be challenged with tasks that refer to skills and knowledge just beyond their current level of mastery. This will capture their motivation and build on previous successes in order to enhance the confidence of the learner.”

7. The new instructor:

The most important responsibilities for the instructor are: to monitor students’ progress towards mastering the required knowledge and skills and; to guide students towards understanding and correctness through constructive feedback, culminating in a weekly one hour class-time (face-to-face or online). Class-time is an opportunity for the instructor to focus on guiding the quality of learning outcome rather than knowledge transmission. Class-time for the students is an opportunity to engage in learning outcome discussions. Assignments are replaced with weekly tasks that represent 20-40% of the students’ marks. Formative assessment, as opposed to summative assessment, is based on *‘effort towards correctness’* and is carried out by the student’s peers - not the instructor.

A number of University of Alexandria instructors indicate that in order for students to learn, especially new information, the instructor needs to “give” this information to their students in the form of a lecture. According to Alan Guskin (1997), “students retain less than 20 percent of what they were taught one week after the lecture.” When you include the percentage of students who are absent or have their own 'agenda' during a lecture, the actual value gained during a lecture is questionable. An instructor spends a considerable amount of time preparing and giving lectures designed to transmit knowledge to their students. Class-time should be a time for the instructor to: give feedback that reinforces understanding and; receive feedback from students regarding any miss-understandings. This cannot happen unless the learner has made an attempt to understand the course concepts by independently and collaboratively engaging in learning tasks prior to class-time with the instructor.

8. Stages of learning:

D4LP has an innovative 'learning environment' designed to challenge and motivate a learner to engage in constructing their own understanding of new knowledge. This results in higher levels of learner participation, learner confidence and learning outcome.

Within each learning environment, there are five stages in which students, individually and collaboratively, engage in mastering each task. Throughout the five stages, students are challenged and motivated to engage in learning. The process builds confidence and enables students to independently discover and collaboratively construct meaning. With participation in weekly learning activities, higher levels of learning outcome are achieved. Students provide and receive ongoing feedback; develop and improve their listening and communication skills and; with a higher understanding of the problem, students can engage in class-time discussion for deeper understanding. Class size and the providing/receiving of ongoing constructive feedback is no longer a concern for instructor or students.

Stage 1: The learner is given a task, an open-ended question, requiring her to state what she believes is the correct solution to the problem. Working independently, the student needs to make an effort to master the learning task.

Stage 1 **Design part 1**: The design of the task should pose an open question and requires the learner to solve a practical problem.

For example the learner is to:

- Carry out procedure x and identify challenges encountered
- Assemble x and identify challenges encountered
- Determine why x is happening and recommend changes to its process
- Evaluate the merging of x with y and identify challenges
- Devise a procedure to improve x and identify challenges
- Evaluate difficulties to growth
- Plan a new direction and identify challenges
- Produce a plan for implementing change and identifies challenges

Stage 1 **Design part 2**: Next, define the criteria that determine the knowledge comprehension skills needed to successfully solve the problem (knowledge comprehension is achieved as learner references resources i.e. technical manuals, textbooks, etc).

Criteria examples:

- Your solution must show where x principles are being applied
- Compare the difference between x and y
- Summarize your results and indicate how x was defined.
- Explain in detail what would happen if x **wasn't** implemented
- In your solution compare the difference between x and y
- Describe the procedures used to determine x

Stage 1 **Design part 3**: Define the resources that will assist the learner in the mastery of the required skills. The design of task 1 determines the level of a learner's motivation and the quality of their learning outcome. For learners to actively discover knowledge, the assigned resources (technical manuals, textbook, learning object, hand-on experience or mini presentation) are *only* of value if the learner is motivated to reference the resources (that is the job of the problem based task). The best resources are those that can be quickly referenced. Also, (if appropriate) provide resources with varying points of view.

Note: Avoid including lectures or PowerPoint presentations:

Stage 2: After submission of task1, the learner will receive three submissions from her peers (classmates). She will not only see the solutions of her peers, she can re-think the problem by comparing her own submitted solution to that of three peers. The student must: review the three submissions and provide constructive feedback to each of the three peers and; rate the effort each peer made to produce the solution (5 point scale).

***Note**: The identity of the peers is not disclosed to the learner.*

Stage 3: In turn, the student receives anonymous feedback from three of her peers on the task she submitted. The student must: review each feedback provided and; rate the effort each peer made in giving her feedback (5 point scale).

***Note**: The identity of the peers who gave the feedback is not disclosed to the learner.*

Stage 4: The student is then placed within a team of four and will know the identity of her team members. The team is assigned either the same task or one that is more challenging to work on collaboratively. Students must: engage with their team members to complete the team task and; rate the effort each team member contributed to the completion of the team task (5 point scale).

***Note:** Although the identity of team members is known to students, they do not know how they were assessed by individual team members.*

Stage 5: The instructor and learner engage in either face-to-face or online discussion of the week's learning task. The learning environment shifts the role of an instructor away from introducing new information to students in the form of a lecture to: guiding and responding to the students based on their independent and collaborative effort towards mastering a problem (stages 1-4). The instructor: reviews either all or some of the team submissions. The instructor then guides students through any misunderstandings/problems and discusses the challenges that individuals and teams encountered in preparing their tasks.

The 5 Stages of learning: Each stage is an important step towards learners gaining their own understanding of the problem and; their development of the confidence to constructively challenge and collaborate with their peers and project leader.

Stage 1	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**
Individual effort	Feedback to peer	Feedback from peer	Team effort	Live feedback

9. Timeline:

Typically, if an instructor lectures three hours per week, then two of these hours would be transferred to the students to work on Task 4 as a team, and the third hour would be for students' class-time with the instructor. With the D4LP learning environment, an instructor is expected to spend three to four hours per week monitoring and one hour per week facilitating class-time for the duration of the course. The student is expected to spend three to six hours a week engaged in solving an application and one hour engaged with the instructor in class-time. "The theory [that]…learners learn by becoming involved…seems to explain most of the empirical knowledge gained over the years about environmental influences on the learner's development." (Astin, 1985).

10. Measurable outcomes

Each program needs to define measurable learning outcomes, describing what the learner will achieve upon graduation from the program. These measurable learning outcomes form the foundation for the type of courses offered within each program. Based on the program learning outcomes, each course must have specific, relevant, measurable learning outcomes defining what the students will achieve upon successful completion of their course. Authenticating learning outcomes at the program level is derived from the success of student learning across the courses related to each of the programs' learning outcomes. This generates evidence of the correctness of each of the programs' learning outcomes, and the quality of learning within the program. Within D4LP, there are two forms of assessment of learning outcome:

- <u>Formative assessment</u>: Marking for effort towards correctness / weekly tasks / providing and receiving constructive feedback (see D4LP learning environment, Stages 1-5);
- <u>Summative assessment</u>: Marking for correctness / mid-term and final exam.

11. Formative Assessment:

Encouraging the students to make an effort for which they are subsequently provided feedback is the key to their mastery of learning. Within each learning environment, students are assessed by their peers on the effort they made towards mastering a particular competency. For each learning environment, the student will be assessed nine times. Two-thirds of the assessment is provided by peers who are anonymous to the student, and one-third provided by known team members. Peer assessment is based on effort towards correctness. This assessment by one's peers represents the student's learning outcome (effort=learning). Knowing their peers will be reviewing and providing assessment motivates and stimulates students to make their best effort. The criteria for peer assessment are defined by the instructor. "Experiences revealed that peer-assessment, as a formative assessment method and as a part of the learning process, can be valuable because students are more involved both in learning and in the assessment process and because they find it fair and accurate." (Sluijsman, Docky and Moerkerke, 1996).

12. Engagement

- Learner Engagement (50% of course time): Students engaging in challenging activities towards mastering the required knowledge and skills (for which they are required to make an effort).
- Constructive Feedback (50% of course time): Students giving and receiving constructive feedback to each other and; the instructor giving constructive feedback to students in class-time.
- Learner Collaboration with Peers (2/3 of all learning activity): “Collaboration is a process by which individuals negotiate and share meanings relevant to the problem-solving task at hand.” (Roschelle &Teasley,1993).
- Resources: formal lectures are eliminated and replaced with resources (textbook, etc.) to assist the students in mastering challenging activities.

13. Pilot Study

In 2008, UBU completed an extensive pilot study on ‘Rethinking Learning’ and the effect on students’ learning outcome (‘Mobile Learning Project, Richards, Inprasit, and Sophakan, 2010).

The student survey results showed a substantial shift in their attitude towards learning and taking responsibility for their own learning. Without this change, we could not anticipate a change in students’ learning outcome. The results of the survey completed by thirteen out of the twenty-two instructors showed a marked change in their teaching philosophies and increased confidence in their ability to contribute to their students’ learning. Twelve of the thirteen instructors who completed the online survey indicated that, although the D4LP method initially required a lot of rethinking on the design and delivery methods of their course, they were looking forward to teaching with this method for the next offering of their course.

Of the students surveyed, 78.09% indicated that they would enroll in other courses taught by the D4LP method and 85.69% indicated that this method of learning was more rewarding than attending lectures.

For 10 of the twenty-two courses involved in the Pilot Study, we were able to compare the final exam marks between the D4LP method of teaching and learning and these same courses when they were previously offered with the traditional lecture-centred method of teaching and learning. The results showed that for 741 students enrolled in courses using the D4LP method, their final exam average was 17.31% higher than the 515 students enrolled in the traditional lecture-centred courses.

14. Rethinking Learning Project:

“Educational research offers compelling evidence that students learn mathematics well only when they construct their own mathematical understanding.” (Tusgate, 1996, p. 4) This applies to any subject, but it is especially true when mastering a skill.

For any learner to obtain a quality education the conditions for both learning and training strategies needs to go well beyond conventional teaching and learning methods.

University of Alexandria pilot project will focus on instructional challenges and will allow us to:

- Design courses that will engage students in critical thinking and interpersonal skills.

- Monitor learning behaviour and authenticate mastery of critical thinking and interpersonal skills.
- Link academic program's learning objectives directly to students' mastery of learning outcomes.

Telecom Egypt pilot project will focus on workplace performance (behaviour) challenges and allow us to:

- Design training projects that will engage staff in critical thinking and interpersonal skills.
- Monitor behaviour of staff as they engage in skills change.
- Authenticate change in workplace behaviour.
- Link Telecom Egypt's criteria for success directly to staff performance.

Conclusion

Transforming how institutions implement their teaching and learning strategies is a difficult but not an unattainable task; it will require the community to engage in the process of re-thinking how learning happens. The challenge then is for teaching to focus on student learning rather than on content delivery.

Factors affecting improvement in learning is a shift in a learner's attitude and behaviour towards learning. Any student willing to make the effort to be responsible for their own learning can excel academically and professionally. However, first we need to change the mindset of educators; none of this will change unless institutions have the strength and resolve to change from the traditional lecture-centred method. Without educational leaders' responsibility for the outcome of their product (change in learning) improvement in learning outcome will not occur.

By focusing on learning, the University of Alexandria and Telecom Egypt have the potential to offer programs that are academically more successful than similar programs offered at top universities or businesses.

Once considered a constant, the focus on content rather then learning is now being viewed as an obstacle to learning outcome; a flaw in methodology within university teaching and learning. The University of Alexandria and Telecom Egypt will continue to monitor learners as they engage in future courses designed with a focus on learning. This direction does not require funding for new structures, technology, additional learning resources or more classrooms. Rethinking learning does require commitment from administrators, program directors, and individual instructors to re-visit how learning happens; it requires them to support broad changes across entire programs, not just specific courses. Both the University of Alexandria and Telecom Egypt recognize the need for real change and are rethinking their teaching and learning strategies. If, as Barr and Tagg (1995) suggest, "universities are about producing learning and not delivering instruction…", then University of Alexandria and Telecom Egypt are heading in the right direction.

Testimonials

D4LP has opened up a totally new and flexible teaching and learning strategy for Ubon Ratchathani University (UBU). D4L has made available the potential for UBU to change from its current lecture-centred model and all its inherent instructional challenges, to a process that allows students an opportunity to fully develop their critical thinking and interpersonal skills (rather than become rote learners).

Dr. Utith Inprasit, Vice-President Academic, Ubon Ratchathani University,Thailand

All senior executives should be forced to participate in a D4LP workshop in-order to gain a better understanding of:

- *Why traditional staff training methods are passive and offer little if any change in learning*
- *Why learning centred training is an active process and far more productive in developing advanced change in a staff member's critical thinking and interpersonal skills.*

National Broadcasting and Telecommunications Commission of Thailand

Thailand's Office of National Educational Standards and Quality Assessment has issued a directed to improve the quality of learning in Thailand. In order to improve learning outcome all universities need to change their current teaching and learning strategies. Transforming a university into a "Learner Centred" university is a difficult but not an unattainable task; but, it will require the entire academic community to engage in the process of re-thinking how learning happens. A universities most difficult challenge is focusing their academic programs on student learning rather than on faculty teaching. D4L's learning outcome teaching and learning strategy is the model that will assist us towards achieving this goal. And unlike the majority of universities that are recognized for the quality of student they accept, we will be recognized for the quality of student we graduate.

Dr. Suchin Visavateeranon, Vice-President Academic, Sukhothai Thammathirat Open University, Thailand

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An Asynchronous, Personalized Learning Platform – Guided Learning Pathways

Cole Shaw, Richard Larson, Soheil Sibdari

Abstract

The authors propose that personalized learning can be brought to traditional and non-traditional learners through an asynchronous learning platform that recommends to individual learners the learning materials best suited for him or her. Such a platform would allow global learners to advance towards individual learning goals at their own pace, with learning materials catered to each learner's interests and motivations. This especially proves useful to learners in developing countries who may not have access to traditional learning opportunities. This paper describes the authors' vision and design for a modular, personalized learning platform called Guided Learning Pathways (GLP), and its characteristics and features. We provide detailed descriptions of and propose frameworks for critical applications like the Content Map, Learning Nuggets, and Recommendation Algorithms. A threaded user scenario is provided for each application to help the reader visualize different aspects of GLP.

Keywords— online learning, asynchronous learning, personalized learning, learning styles, pathways, content map, instructional technology, recommendation algorithm

INTRODUCTION

Education is experiencing many shifts; Clayton Christensen says that it is being "disrupted" by online learning [**1**]. The Khan Academy [**2**] has enabled widespread blended learning, and prestigious universities like Stanford, Harvard, and MIT have adopted online education through MOOCs (Massive Open Online Courses).

However, many of these platforms still utilize the industrial model of education with a "pre-defined course," where all students must try to learn the same topics at the same pace during a set time period. Many students drop out—they may have the ability to learn the material, but struggle with the time constraints [**3**]. Others, especially those in developing countries, may not have the educational background or regular access to technology to succeed in current MOOC courses [**4**]. Nonetheless, global broadband access on both fixed and mobile devices is growing, with 75% of current mobile subscriptions in developing countries and overall mobile access growing at about 60% a year, showing that more learners will have access in the future [**5**]. However, as people in developing countries gain access to quality educational materials online, we need to ensure that the materials are appropriate for their backgrounds. Personalized learning platforms that let people learn on their own schedules, with materials suited to their individual needs can address this issue in all countries.

The goal of using technology to achieve personalized learning stems from the work done by Bloom in 1984 and his "Two Sigma Problem," which showed that one-to-one tutoring coupled with mastery learning improved student performance two standard deviations above that of a traditional classroom [**6**]. More recent research in traditional classrooms has also shown the benefits of letting students learn at their own pace and focus on topics that interest them [**7**] [**8**].

Recommendation algorithms to support flexible and personalized learning have been explored by many, such as [**9**] [**10**] [**11**] [**12**] [**13**] [**14**] [**15**]. These studies have shown promising results at both the course level as well as for individual learning activities. Their systems cater to the needs of individual learners, allowing them to learn topics based on their interests and backgrounds.

However, a large-scale solution that reaches millions of students has not yet appeared. Researchers and startup companies have begun exploring adaptive technologies to support personalized learning in classrooms, although a comprehensive solution for non-traditional learners has not yet appeared (see [**16**] [**17**] [**18**] [**19**] [**20**]). Siemens, et al., propose perhaps the most comprehensive such platform, which they call Open Learning Analytics [**18**]. While the concept is similar to GLP in terms of use of analytics to improve individualized content delivery, their platform focuses on organizational and institutional use, and limits learners to traditional "classes" instead of topic-based learning. Furthermore, by incorporating concept maps, GLP allows both traditional and non-traditional learners to take an assessment test and place themselves into the appropriate learning location on their concept maps.

The European community has developed a large-scale solution for personalized learning, called ROLE (Responsive Open Learning Environments), which does cater to non-traditional learners [**21**]. Currently being tested in five different testbeds, ROLE focuses on a completely learner-driven environment, with minimal guidance and direction from educators or experts. In the ROLE scheme, educators assist learners by creating widgets that help teach specific concepts, rather than directing learners towards certain topics. In turn, learners can "mash up" different resources to create individualized learning experiences. GLP falls somewhere in between ROLE and Open Learning Analytics when looking at educator and learner roles—it provides a learner-centered environment, but with guidance from educators and domain experts.

While GLP would require significant up front investment to create adequate content and the base platform, the added cost for each additional learner would be minimal. This type of investment would be suitable for large, introductory university courses such as Calculus I, where hundreds of thousands of students with very diverse interests enroll every year—over two hundred thousand enrolled in Calculus I courses in the United States alone, in 2005 [**22**]. Over time, researchers and companies would be able to design new and improved applications (apps) that interact with the platform through standard communication interfaces.

This paper presents an overview of the Guided Learning Pathways system with additional detail on the apps that would interact with the core platform. A threaded example that continues through each app provides details on how the third-party apps could interact with an example learner.

OVERVIEW OF GLP

Many recent publications and companies put forth ideas for personalized education platforms in classrooms [**16**] [**20**] [**23**]. However, these platforms require the use of a teacher or in-person facilitator to guide the students or to teach the content—this limits their reach and impact. As an alternative, GLP provides a large-scale, asynchronous platform where domain experts can encode their guidance, which could then be accessed by large numbers of learners, including non-traditional learners. Non-traditional learners include lifelong learners or those from low-resource regions.

GLP is a modular platform, and as new learning technologies emerge, new apps could integrate in. Different learners could select which type of app they wish to utilize—one may wish to use a crowdsourced *content map*, while another may wish to use a custom version created by a high-school teacher in the U.S. (Figure 1).

Insert Figure 1 here.

Figure 2 lists some GLP terminology, with more detailed definitions in later sections.

Insert Figure 2 here.

As learners make their way through individual pathways, each has a personalized experience. GLP will access data repositories of learning nuggets, like MIT's Core Concept Catalog [**24**] and recommend to each learner the nuggets most suitable for her. GLP determines suitability based on each learner's learning style preferences, personal interests, and other learners' success with each nugget; however, learners will be free to choose the resources they use. Even though it has not been proven that there exists a single, unique learning style per individual [**25**], learners may define a preference but select what seems more engaging for them at any given moment. As more learners use the system and GLP gathers better data on nuggets, GLP can discard poorer performing nuggets.

Analyzing learner history and performance, GLP can also match learners into learning communities, which can help learners master content [**26**]. These communities could consist not only of other learners (as in the OpenStudy model, see [**27**]), but also live human tutors who interact synchronously with the learners in individual tutoring sessions.

As shown in Figure 1, the GLP platform will be modularized, and different organizations or individuals can plug-in their apps. Envisioned apps could include (but are not limited to): 1) content map, 2) data repository, 3) intelligent tutors, 4) learning communities, 5) learning nuggets, 6) recommendation algorithms, and 7) user interfaces. Several of these will be described in more detail later. This document presents a fluid and evolving description of GLP, and the examples described within represent possible implementations—readers should not interpret them as being the only implementations.

LEARNERS

Description

We begin by defining GLP learners. As mentioned in the overview section, we envision that both traditional and non-traditional learners will use the GLP platform. Traditional learners are those in age-appropriate learning environments with access to a qualified teacher, while non-traditional learners may include lifelong learners with specific learning needs, youth in rural areas, or people in developing countries. By giving non-traditional learners opportunities to learn from high-quality material appropriate for their knowledge levels, GLP differs from current MOOC trends (which offer high-quality materials at a standard difficulty level, which may not be appropriate for many learners).

Each learner embodies a set of inherent attributes that GLP uses to improve her learning and better engage her. Some of these may include her non-academic interests—for example, if she is a Boston Celtics fan, she may be recommended more basketball related nuggets. Similarly, her explicit educational learning goals (i.e. introductory biology math) and interests (computational biology) help GLP focus the types of material and topics presented to her.

A learner may also have learning preferences that change over time. Parameters like her preferred learning style (i.e. visual, textual, or auditory) or even her preferred interface style (i.e. node-based, virtual world) could be adapted to better engage the learner and improve her learning.

Determining Learner Attributes

Some learner attributes can be determined by GLP upon registration, either through a questionnaire or assessment test. As GLP gathers more information from a large number of learners and learns more about each individual's learning patterns, its recommendations should improve. For example, a learner may claim a preferred learning style of visual materials, but GLP notices that she actually performs better when using auditory materials and adjusts her preferences automatically. More detail on this is provided in the Nugget Recommendation Algorithms section. Figure 3 summarizes key learner attributes.

Insert Figure 3 here.

Threaded Example

María Lopez García wants to study ecology, but she needs to work full-time to support her family. Thus, after finishing high school, she took a job as an administrative assistant at a local clinic. She just finished her first year of work, but wants to improve her education and open up future career opportunities in forestry. Her friend José tells her about this online program that can help María refresh her high school biology and help her learn what she needs for a career in a natural protected area.

After María gets home from work, she finds the Guided Learning Pathways website and registers. She is presented with several different learning materials talking about trees. One is a visual resource that shows her a small video and some graphics, another is a text passage describing the same information, and a third is an audio recording of a botanist in the field describing a rain forest. GLP asks María which material she preferred, and she selects the visual category. GLP records this and will use that information as her initial learning style preference—GLP will initially recommend more visual nuggets to her, but it may adjust the recommendations as it learns more about her learning habits.

María also has a chance to list some of her non-academic interests. This information will help customize the problem sets and nuggets that GLP recommends to her, and it could be used to match her up with an on or off-campus learning community. She imports her Facebook interests, which include salsa music, football, and food.

USER INTERFACE

Description

The user interface allows each learner to navigate her pathway through a visualization method that is more intuitive for her (*pathways* are described in the Content Map section). One can imagine that these interfaces are further personalized with overlays—for example, John and María might both prefer **geographic** interfaces, but John likes baseball and María likes football, so John's content topics are mapped to baseball stadiums while María's are mapped to football stadiums. Even if John and María interact during the same activity, they each see different views. Current data visualization tools allow users to see data in different forms; with GLP, learners would be able to interact with the same core set of data and learning materials, but through completely personalized interfaces. A simple example is the skins that people use to customize software like Gmail or Winamp.

Threaded Example

After importing her Facebook interests, María then has a chance to pick an interface style. GLP offers some pre-defined categories, including node-based (Figure 5), geographic-based (Figure 4), and 3D virtual world. Since María enjoys geography, she selects the geographic option. GLP knows that she has an interest in football, so it uses a football overlay. GLP starts her off with a trip around the world. and asks her to visit all the countries' national stadiums that participated in the 2010 World Cup, with a general East-to-West direction of travel. She sees the initial map from Figure 4, which shows different topics in biology calculus overlaid onto baseball stadium locations.

Earlier in the afternoon, María had chatted with a new friend in the class, Mark. Mark prefers simple interfaces, and he selected a node-based interface. María appreciates that she could select an interface that would be more dynamic and engaging for her.

Insert Figure 4 here.

CONTENT MAP

Description

After a learner registers, she is introduced to the GLP content map. The content map takes the traditional, high-level idea of a subject (like calculus) and breaks it down into topic-based maps. This idea has been explored in *learning trajectories* (used in youth math education) and ASSISTments [**28**] [**29**]. The GLP maps could initially be designed by domain experts and then refined over time with user data. Instead of every topic being linearly connected as in a course syllabus or textbook, topics would be connected to related topics, and such topic-strings could be learned in parallel. For example, learning *Fractions* does not depend on knowledge associated with *Exponents*, so the two concepts could be learned in parallel; on the other hand, *Addition and Subtraction* needs to be learned before *Multiplication and Division*, so these topics must be learned sequentially [**30**]. Thus, embedded within each topic is a list of pre-requisite topics that a learner must master beforehand.

When she registers, the learner takes an assessment test to determine her mastery level and placement on the content map. Given the pre-requisite relationships within GLP, it will be assumed that if a learner tests out of a topic, she will also have mastery of the pre-requisite topics. If it is later discovered that she is weak in a specific area, GLP can add topics to the learner's pathway and reinforce her knowledge. As the learner uses GLP, she can also test out of topics through an assessment test. The required mastery level for each topic will be discussed in the next section, and could differ among learners.

By focusing on topics instead of "classes," GLP enables more efficient learning of core topics across disciplines. For example, physics and calculus might share many of the same topics, and in a content map the shared topics could be merged to reduce redundancy and show concept relationships.

Content Map Customization

The content maps could also be customized for different majors and interests. Tailoring subjects like mathematics to engineering has been shown to improve student engagement and retention at several universities in the U.S.A. [**31**]. The National Research Council's (NRC) BIO2010 report also supports the idea of specialized math; the NRC outlines the specific mathematics requirements for an undergraduate biology curriculum [**32**]. Thus, in GLP, biology majors could each learn what is relevant for their interests, with examples and topics oriented towards their field. An extension of this idea would be that different majors might have different levels of mastery required for different topics. Biology majors might need to master *Derivatives* at only an application level, whereas engineers might need to master it at a synthesis level (in following Bloom's original Taxonomy [**33**]).

Learner-generated changes in the map could be driven by annotations, such as how Boston Children's Hospital's OpenPediatrics project allows users to annotate and comment on video lecture snippets [**34**]. As learners use nuggets and note areas of confusion or add resources to clarify a topic, other learners can comment on the usefulness of these resources. Topics can then be broken down to create a more detailed content map. At the university level, MIT Crosslinks provides one example of an expert-generated content map for calculus [**35**]. A portion of the Crosslinks data is shown in Figure 5.

Insert Figure 5 here.

Another way to modify the map could be through learners. Research has shown that infants learn reading through different pathways [**36**]. One can imagine that sequences of topics are chained together, but different learners might learn each sequence in a different order. However, this will need to be better defined through more research—GLP could enable this by including a framework to allow learners to try different sequences of topics.

Figure 6 summarizes the content topic attributes that each topic will need to have.

Insert Figure 6 here.

Topic Mastery

When examining a content map, links between content topics show a pre-requisite relationship. Mastery of all pre-requisites is required before studying follow-on topics, and the level of mastery required could differ per learner, as described in the section above—thus, learners must take an assessment test before they can move on from any given topic. Bloom's Taxonomy (and its revised version) offers ways for GLP to define these assessments [**33**] [**37**]. In their revised taxonomy, Anderson and Krathwohl offer action-oriented ways to measure student learning (pp 67-68) [**38**]:

Remembering*: Retrieving, recognizing, and recalling relevant knowledge from long-term memory.*

Understanding*: Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.*

Applying*: Carrying out or using a procedure through executing, or implementing.*

Analyzing*: Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.*

Evaluating*: Making judgments based on criteria and standards through checking and critiquing.*

Creating*: Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.*

Once a learner has demonstrated the appropriate level of mastery, defined by their individual needs and learning goals, they can move on to other topics in their pathway.

Pathways

As defined above, pathways are sub-sections of the content map that help achieve specific learning goals. These pathways could be pre-defined by domain experts or determined by aggregated learner history. For example, looking at Figure 5, one can see that a pathway to learn *Newton's Method* goes through *Function*, *Derivative*, and *Taylor Series*.

To determine which pathway a learner should follow, GLP uses a learner's learning goal and major field of study. This pathway could be crowdsourced from other GLP users and then tailored for each individual. One could imagine that some learners might need a refresher on polynomials, which would be an added step between *Taylor Series* and *Newton's Method*. A learner's overall pathway should include her explicit learning goal, if she picked a specific topic (i.e. *Derivatives*), or all of the topics related to her field of study (i.e. introductory biology calculus).

When a learner registers and a pathway is determined, GLP places her onto the appropriate starting point of her pathway. The exact location depends on each learner's previous knowledge mastery and assessment results.

Threaded Example

GLP analyzed María's learning goal of a biology and ecology career. It has determined that she needs to master a set of topics from the calculus content map—the blue and red arrows in Figure 8 represent two different *pathways* between topics within biology calculus that both allow her to achieve her learning goals. Figure 7 shows one possible topic mapping for the blue arrows, using data from MIT Crosslinks [**35**]. María can select the pathway that seems best suited for her, with some guidance from GLP. Based on the popularity rating of the blue pathway, she chooses to follow it first—if it does not seem to be working, she can always change later on.

Insert Figure 7 here.

Insert Figure 8 here.

María then gets a short assessment test to determine where on the blue pathway she should start. GLP finds that in some topics, María is actually at an intermediate level, while in others she is at a basic level. GLP records the topics that she already knows and places her at the start of the pathway—María needs to review some topics.

Content Recommendation Algorithms

Description

Guidance through content maps has been researched before. One example of this in an online context is the ELM-ART project, which shows learners which topics they are prepared for and which ones they should study later through a traffic-light icon [**39**]. GLP builds upon this by allowing different learners to have different content maps to suit their learning needs (as mentioned in the Pathways section, individuals learn things in different orders). Furthermore, GLP will allow personalization of the learning materials, exercises, and example.

Similarly, García et al., report on a tool that provides peer and student feedback and recommendations directly to teachers, to help them improve courses over time [**11**]. This tool allows teachers to share course materials and looks for trends in effective course components, i.e. was forum posting correlated with high or low test scores, was a specific unit correlated with better course performance, etc. GLP builds upon this content-level work by automating the feedback and improvement process, and then offering better pathway recommendations to individual learners. Instead of the course changes affecting all learners, only those who would perform better would see the change. For example, García et al., discuss a forum, which may be unhelpful for most students (low forum participation correlates to high scores). Under their scenario, a teacher may decide to remove the forum entirely. However, that forum may be beneficial to a subset of learners—GLP would be able to detect the difference in utility across learners and recommend the forum (or learning unit, etc.) on the pathway of a subset of learners but not others.

Thus, two "levels" of recommendation algorithms will be used by GLP: for the content topics and the nuggets. It can be imagined that different types of algorithms are tested at each level or adapted to individual learners and backgrounds, so that learners receive the most useful recommendations for them. Here we describe the content topic recommendation algorithms.

The content topic recommendation algorithm identifies the content topics that remain on the learner's pathway, which he or she has not yet mastered. GLP then recommends those topics where the learner has mastered all pre-requisites, or topics with no pre-requisites. The learner can also follow her self-interest and choose to study topics not on her formal pathway, but where she has also mastered the pre-requisites.

Threaded Example

Since María selected the blue Pathway, GLP calculates the topics where she showed sufficient mastery in all the pre-requisites. However, during her assessment test, María did not achieve mastery in any topic, even though she did demonstrate knowledge in some of the basic topics like *Derivatives* and *Functions*. As a result, GLP searches for topics with no pre-requisites that María can start with.

GLP finds two topics along the blue pathway with no pre-requisites—*Functions* in Australia, and *Differential* in Ivory Coast. It presents both options to María. She still remembers some of the concepts in *Functions* from her high school class, so she decides to visit ANZ Stadium in Sydney.

Learning Nuggets

Description

Once a learner selects a topic, GLP uses statistical methods to infer about her learning preferences and skills in order to recommend the learning nuggets best suited for her (described in the Nugget Recommendation Algorithms section). These nuggets include lectures notes, media (video, audio, etc.), assignments, and assessment tools that are crowdsourced from public contributors as Open Educational Resources, much like Wikipedia. Nuggets will have an associated level of rigor to suit different learners and could range from elementary school to postgraduate level. Each nugget will also receive a dynamic rating that reflects its effectiveness in helping learners master its topic.

The learner studies as many nuggets as she wants, before choosing to take a topic assessment to test her mastery level. If she proves her mastery of the topic, she can move on and select another topic to study. If the learner has not mastered the topic, she will be presented with a re-ranked list of nuggets for the same topic.

To help match nuggets to learners, nuggets need to be tagged with metadata. Some of these have been mentioned above, such as rigor. Others might include learning style or non-academic themes; examples might be videos, lectures, or activities. This requires that GLP include an initial way to identify a learner's preferred learning style. Learning styles could be defined as visual, textual, or auditory—note that this means a video-based resource could be a visual, textual, or auditory learning style, depending on the characteristics of the video.

Nuggets will also be categorized into different types, each of which represents a different pedagogical tool. Some example categories are seen in Figure 9.

Insert Figure 9 here.

Over time, a learner's preferred learning style could be refined from her initial selection by analyzing each learner's behavior in GLP and which nuggets prove most effective in advancing the learner's mastery. While research has not definitively proven that learners have a **single** learning style that helps them learn most effectively [**25**], the idea of providing multiple options that can engage learners in different ways is an alternative solution, incorporated into the Universal Design for Learning (UDL) framework [**40**]. By providing different types of nuggets, GLP merges both approaches and provides the flexibility of UDL and learner choice while also providing a structure for learners who have a preferred learning modality the majority of the time. As Pashler et al. [**25**] mention, there exists anecdotal evidence about individual learners "getting" a topic using some specific learning style when a different style did not work for them before or did not work for other learners, so providing multiple options is essential (and limiting learners to a single style may not be a great idea).

As noted above, nuggets could be crowd-sourced from high-quality, existing OER or created specifically for GLP. A quality-review process will ensure that nuggets meet GLP's criteria for inclusion into the platform. Such crowdsourcing of content has proven successful in other Internet platforms, such as Wikipedia and open-source software like Linux.

GLP will constantly review and evaluate the nuggets after a learner uses them. Over time, if a nugget proves more useful for a subset of learners, GLP will recommend that nugget more often for other learners with similar backgrounds. However, if a nugget proves less useful or detrimental to a subset of learners, GLP will either remove the nugget for that subset of learners or remove it completely from the data repository. Figure 10 summarizes learning nugget attributes.

Insert Figure 10 here.

GLP combines the nugget attributes listed in Figure 10 with learner attributes listed in Figure 3 to create personalized rankings of each nugget for each learner. The most highly recommended nuggets are those that GLP believes can best help the learner master a specific content topic. We provide more detail in the Nugget Recommendation Algorithms section. As third-party contributors create and add nuggets to GLP, learners get presented with more choices in "real-time", as shown in Figure 11.

Insert Figure 11 here.

Threaded Example

María selected to first visit the Socceroos and ANZ Stadium, where she will study *Functions*.

Entering the stadium, she sees that different sections contain different rigor levels and types of nuggets. The **Luxury Suites** are undergraduate interactive applets, the **Lower Section East – Midfield** seats are graduate lecture notes, and the **Upper Section North – Goal Area** seats are undergraduate case studies. It appears that there is one nugget assigned per seat, so she has a wide variety of options to choose from. As she wanders through the Lower Section East – Corner, metal placards on each seat flash at her. Each placard contains a phrase or keyword, and each seat seems to have at least four placards attached. María stops at one seat, and she sees: "Creator: John Smith" "population growth" "video" "visual" "4.2".

NUGGET RECOMMENDATION ALGORITHMS

Description

As mentioned previously, many researchers have also investigated recommendation algorithms using collaborative filtering, preference-based, neighbor-interest-based, and other data mining techniques [**9**] [**10**] [**11**] [**12**] [**13**] [**14**] [**15**]. Nadolski et al. have used simulators to test personalized recommendation algorithms [**41**], and we have created a distinct simulation platform to compare nugget recommendation algorithms [**42**].

The nugget recommendation algorithm identifies and ranks the best nuggets for a learner that will help her master the topic in the most efficient way possible (i.e. in less time, most intuitively, with least frustration). Our method assumes that a large dataset of learning nuggets exists within GLP along with a large number of learners using the platform. There exist many ways to recommend nuggets under these conditions—one envisioned method would be to use the learner's preferred learning style (i.e. visual nuggets), personal interests (i.e. baseball), and historical data about each nugget or sequence of nuggets (i.e. 40% of learners with similar profiles who used nugget X mastered the topic, vs. 70% of learners with similar profiles who used nugget Y mastered the topic). Nugget efficacy can be measured in terms of marginal improvement for similar learners. To find this relationship among nugget efficacy, nugget attributes, and learner attributes, we can use different statistical tools such as regression, prediction models, clustering and classification, and understanding the learner's preferences.

After scoring all nuggets for the learner's selected topic, GLP presents the nuggets in descending order of score, much like a search engine's results page—new (or "unranked") nuggets could be strategically inserted into the top of the list so that learners use them and help them develop a history. Similar to a search engine's results, this list of nuggets will differ between individual learners. From this list, the learner can study as many nuggets as desired (and in any order), and she can choose to follow or not follow the GLP recommendations. When she feels ready to test her knowledge, the learner can choose to take an assessment to measure her mastery level. If she reaches the required mastery level, the learner moves on and selects another topic to study. If the learner returns to the same topic, the nuggets will be re-scored using updated information from all learners, and the learner can select new nuggets to use.

Threaded Example

María stops her random exploration of ANZ Stadium and pulls up GLP's recommended nugget list. She sees that there are over ten pages of *Function* nuggets available in the stadium; the first page includes a mixture of nuggets from the Lower Section West – Midfield, the Lower Section East – Corner, Upper Section North – Goal, and the Luxury Suites. She is free to explore these in any order, or even to skip to later pages on the list. However, she knows that GLP produced this list just for her, based on her interests, background, and other learners' usage of the nuggets.

María wanders over to the Lower Section West – Midfield to read some undergraduate lecture notes from MIT, then heads over to the Upper Section North – Goal to analyze an undergraduate level case study from Stanford. Finally, she plays with some undergraduate level interactive applets in the Luxury Suites made by *MarineBiologist123*, a practicing biologist. María loves exploring ANZ Stadium while learning more about *Functions*!

María feels like she has a good grasp of the concept of *Functions*, so she returns to the ticket office and asks for an assessment test. The assessment focuses on application of her knowledge of *Functions*, instead of just simple regurgitation of content facts or equations. She starts the first problem, but doesn't understand how to get past the second step. She requests a hint, and GLP records this action. María gets past her mental block and finishes the first problem. She works on the other problems and also uses some hints to get through them. She barely fails the assessment at the end, and the ticket office asks María to return to the stadium and try some more nuggets.

María re-opens up the GLP recommendation page sees a new list of nuggets to try—the list has been updated with additional information from other learners and her own history with *Functions*. GLP follows a mastery learning philosophy and expects all students to master each topic before moving on to subsequent topics. Since *Functions* is a fundamental concept for the rest of María's pathway, GLP expects her to achieve at least an *"evaluating"* mastery level with it, based off of its internal model of her knowledge. The system also makes an internal note that María failed her assessment after using the three nuggets and adjusts their ratings accordingly—in the future, it will again try recommending these nuggets for other learners to see how much it helps them, and if the nuggets prove unhelpful, their ratings will decrease. Eventually they may be removed from the GLP data repository.

This time María selects a new Khan Academy video nugget from the Lower Section East – Corner that is also highly recommended, but it doesn't match her textual learning style. After watching the video, she returns to the ticket office and asks for another assessment. This time she does better and passes the assessment. Internally, GLP makes a note of this in María's learner record and also adjusts the Khan Academy nugget's rating appropriately. According to GLP's internal model of María's knowledge, it thinks she has achieved *"evaluating"* level mastery (sufficient for biologists) and marks the topic of *Functions* as "completed" on her records. She receives a ticket out of Australia.

María then returns to the GLP main page and sees the map with her pathway. Australia, and the lines connecting Australia to Cameroon and South Africa are now bright, showing her the other stadiums that she can now visit. These correspond to *Derivatives* and *Fourier Transform*, both of which have *Functions* as their pre-requisite. Furthermore, she can also still visit Ivory Coast (*Differential*), which she skipped last time—it does not have any pre-requisites.

CONCLUSION

In this paper we present Guided Learning Pathways (GLP), an asynchronous, personalized learning platform for non-traditional learners. GLP emphasizes topic-based mastery and provides learners with recommended learning materials (nuggets) that help them achieve this mastery. We describe a general framework for GLP and provide details on six potential apps: User Interface, Content Map, Content Topic Recommendation Algorithm, Learning Nuggets, and Nugget Recommendation Algorithm. In the future, other apps could be developed and integrated into the platform. Examples of each app are provided to give readers a sense of the envisioned capabilities of GLP, though one can imagine additional system functionalities. A threaded example describes how each app would interact with a single learner.

ACKNOWLEDGMENTS

The authors would like to thank Mac Hird, Navid Ghaffarzadegan, Yi Xue, Abby Horn, Peter Wilkins, Brandon Muramatsu, Jeff Merriman, Dr. Jun Wang, Kanji Uchino, Professor Robert

Hampshire, and Professor Chris Dede for their comments and support during many discussions about GLP. We thank Fujitsu Laboratories of America for their funding and support of this project.

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APPENDIX – FIGURES AND TABLES

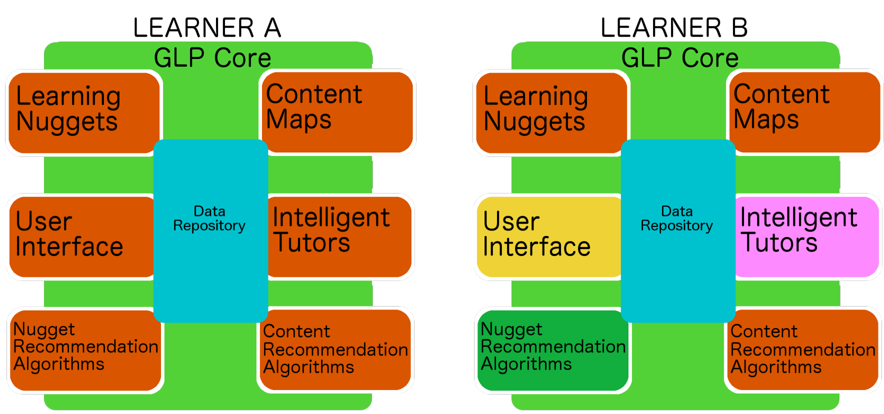


Figure 1. Different Colored Apps Come From Different Providers

Term	Definition
Content Topic	In today's terms, all subjects (such as calculus) are divided into classes that are taught over a semester. GLP eliminates the idea of a "class" and instead focuses on topics—arranged as they are conceptually related to each other instead of

	linearly, as in textbooks. These content maps look like directed, acyclic graphs, such as the Khan Academy Knowledge Map for math topics [**30**]. Content topics that are not directly related to each other can be learned in parallel. Other topics require pre-requisite knowledge that must be learned first.
Learning Nugget	Learning nuggets are the materials used to teach content topics. They are divided into categories such as *case studies*, *lecture notes, videos*, *interactive applets*, or *homework*. Each embodies a certain learning style, such as visual, textual, or auditory. GLP could discover these on the Internet (i.e. OpenCourseWare), access them through data repositories, or accept direct uploads from content creators. Regardless of source, an objective party will screen all nuggets for quality purposes. Screening of existing Open Educational Resources (OER) for quality purposes addresses some concerns that previous initiatives have found [**43**].
Pathway	Pathways are groups of content topics that move a learner towards her learning goal. They include the pre-requisite topics that need to be mastered. The learner can select to learn about topics outside of her pathway, and educators or friends can add topics. Educators can also customize pathways for classes—for example, a biology teacher in Maine may wish to address certain topics that a biology teacher in Arizona may not.

Figure 2. GLP Terms and Definitions

Learning Goal	Major Field of Study	Non-Academic Interests
Preferred Interface Style	Preferred Learning Style	Previous Knowledge

Figure 3. Learner Attributes

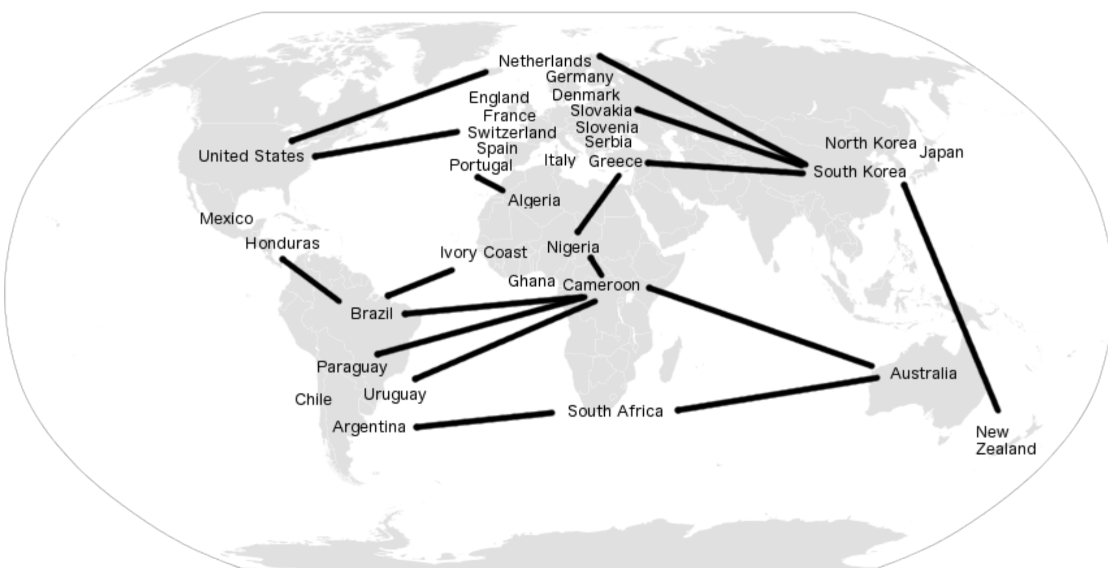


Figure 4. Example of Geographic User Interface (original image courtesy of [**44**])

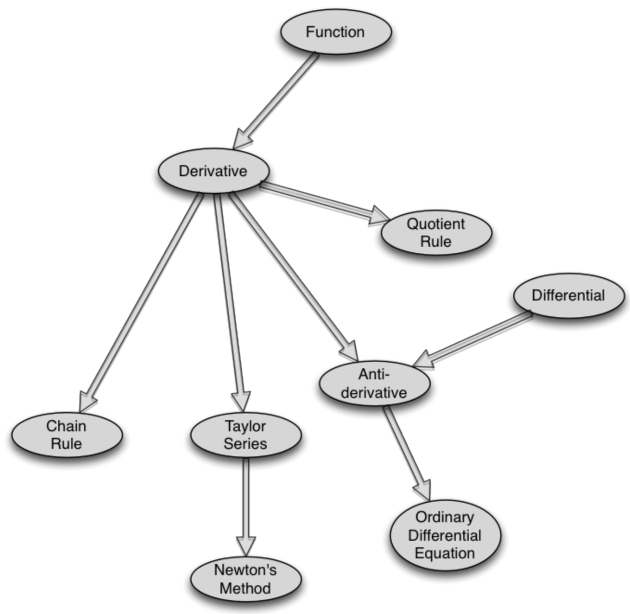


Figure 5. Subset of MIT Crosslinks Data [**35**]

Topic Name	Description	Keywords / Tags
Level of Rigor	Major(s)	Mastery Level for Pre-requisite(s)
Pre-requisite Topic(s)		

Figure 6. Content Topic Attributes

Country	Crosslinks Topic
Australia	Functions
Cameroon	Derivatives
Nigeria	Quotient Rule
Ivory Coast	Differential
Brazil	Antiderivative
Honduras	Ordinary Differential Equation
South Africa	Fourier Series

Figure 7. Blue Arrow Mapping to MIT Crosslinks

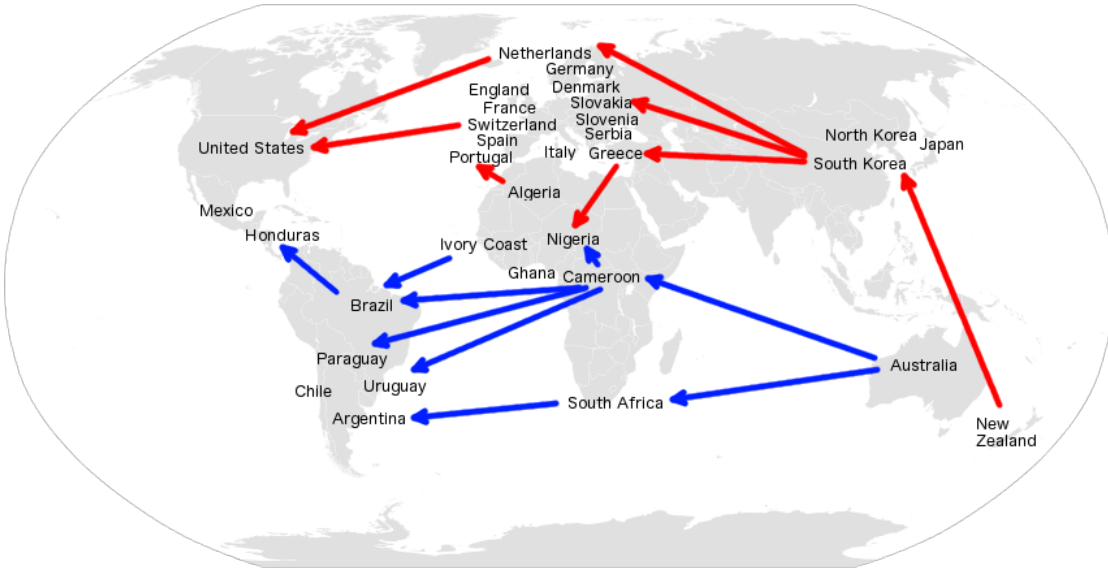


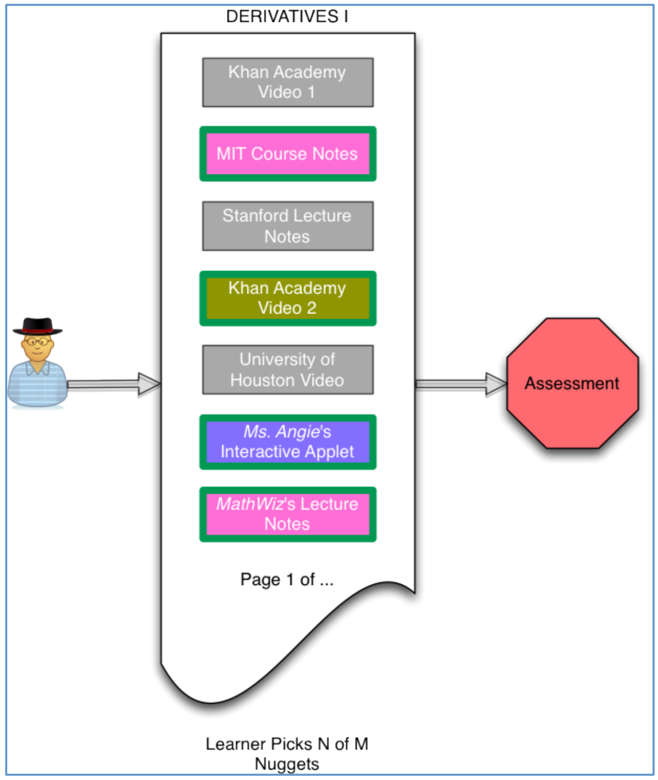
Figure 8. Example Geographic GLP Interface (original image courtesy of [**44**])

Case Studies	Example Problem	Homework
Interactive Applets	Lecture Notes	Simulations
Videos		

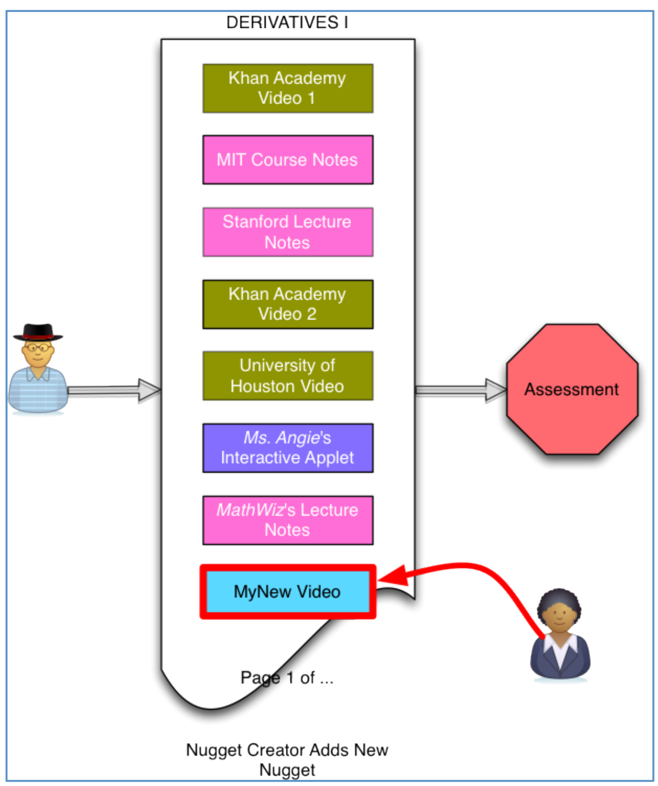
Figure 9. Example Categories of Learning Nuggets

Nugget Name	Description	Category
Content Topic	File Location	Keywords / Tags
Learning Style	Level of Rigor	Major(s)
Nugget Creator	Pre-requisite Nugget(s)	Rating

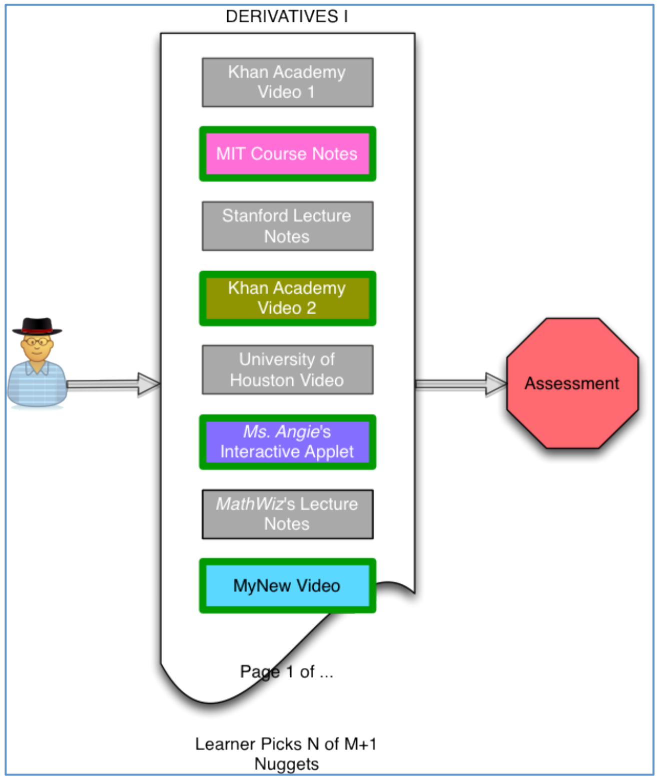
Figure 10. Learning Nugget Attributes


DERIVATIVES I
Khan Academy Video 1
MIT Course Notes
Stanford Lecture Notes
Khan Academy Video 2
University of Houston Video
Ms. Angie's Interactive Applet
MathWiz's Lecture Notes
Page 1 of ...
Assessment
Learner Picks N of M Nuggets

(a)


DERIVATIVES I
Khan Academy Video 1
MIT Course Notes
Stanford Lecture Notes
Khan Academy Video 2
University of Houston Video
Ms. Angie's Interactive Applet
MathWiz's Lecture Notes
MyNew Video
Page 1 of ...
Assessment
Nugget Creator Adds New Nugget

(b)



(c)

Figure 11. (a) Learner Selects N of M Nuggets to Study. (b) Adding a New Nugget Does Not Interrupt Learner Progress—(c) Learner Selects From Larger Pool of Nuggets.

Diversity in MOOC Students' Backgrounds and Behaviors in Relationship to Performance in 6.002x

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Abstract

The first edX course had over 150,000 students enrolled, which included registrants from nearly every country in the world, bringing with them massive international diversity. These students were also diverse on a number of background characteristics. To augment the behavioral and geographical location data available from edX clickstream data, we gathered detailed individual background data for a subsample of students who completed an exit survey. Furthermore, we show that student performance varies significantly with some of these background characteristics. Our descriptive work highlights the important challenges that such a diverse classroom poses for instructors, course designers, and education researchers.

1. Introduction

The new global wave of large virtual courses offered for free has attracted an incredibly diverse population of students. In this paper, we apply a descriptive lens to the first massive open online course offered by MITx, "6.002x: Circuits and Electronics." The doors to this class, traditionally taken by computer science and electrical engineering sophomores at MIT, were thrown open wide to the world. Participants in 6.002x included advanced engineers already practicing in the field, high school students in Mongolia, and casually interested learners in nearly every country. We demonstrate there is a high degree of variability in all measurable dimensions for the participating students. This variability poses challenges and opportunities for researchers, instructors, and course designers.

2. Research Questions

In this study, we ask, broadly, "What variability do we observe in the background characteristics of the students and in their use of the 6.002x site?" We focus on three important areas of the student experience in this paper. More specifically, we ask,

a. What is the variability in location and behavior surrounding site access and site use?
b. For students who completed the exit survey, what is their prior exposure to the content, and what is their familiarity with teaching the content?

c. For students who completed the exit survey, what are the reasons they cite for having taken part in the course?

3. Findings

We organize the findings of our study as follows. First, we describe the variability we observed in the location from which the users access the site. We then focus on the explanatory power of more detailed student background information from students who completed the exit survey. The exit survey includes prior educational experiences as well as relevant content experience and stated motivation for enrolling in the course. Most survey completers were also certificate earners, though numerous students who were still active on the site at the end of the course in June also noticed the announcement about the survey and responded to it.

Although the sampling frame for this study comprises students who were given the exit survey, it is important to note that the survey was administered using matrix sampling. In other words, every student was given a random selection of questions from the survey, and, thus, some students were not given the opportunity to answer some questions. In figures below, “NA” denotes the students who did not receive the associated question on the exit survey. We therefore conduct one-way analysis of variance tests on the sub-sample of students who were administered four important questions related to offline collaboration, educational attainment, experience teaching this content, and reason for enrolling in the class. We illustrate important variation in performance by these four key background variables. Previous research on residential education indicates that these constructs are important in explaining variation in performance (e.g., benefits of collaboration: [1, 2]) and may also be significant in this new virtual learning environment.

3.1. Variability in location

First, we show that there is a large degree of geographic variability, indicating participation from students around the world. After determining the students’ points of access via IP addresses, we found that students logged on to the site from nearly every country in the world. However, the level of participation was highly skewed, with only twelve countries individually accounting for greater than 2% of all participating students each. Most countries had less than one hundred participants. Furthermore, a significant number of students accessed the site from multiple locations. Our data showed that a number of 6.002x participants were highly mobile, and logged on from multiple countries. Whereas many online education programs have been geared towards local populations, MOOCs are a global opportunity for a globalized audience.

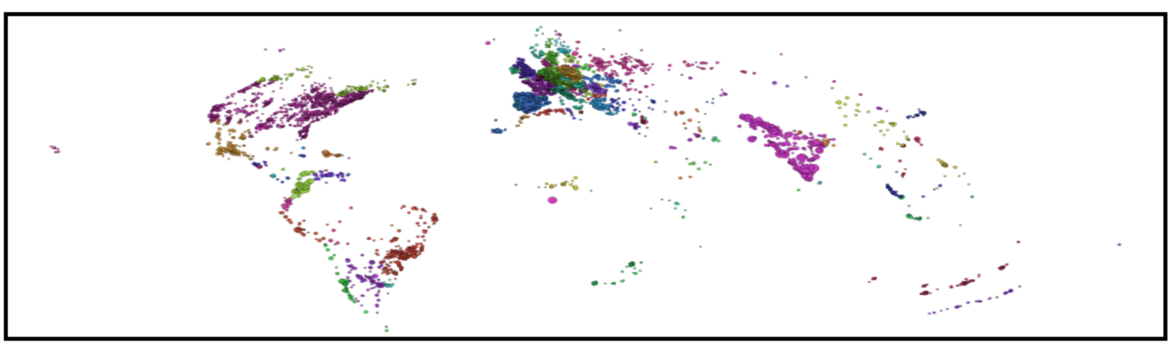

Figure 1. Geographic location of participating students

Additionally, students participating from different countries performed at different levels and spent varying amounts of time on the site. Table 1 illustrates the variation in participation (overall registration as well time spent on one of the website components—the homework problems) and in performance (number of certificate earners and average points earned out of 100) for the top 12 countries represented. Points, here, are out of 100, indicating the grade for the whole course. The mean performance includes all students in that country; points distributions were highly skewed upwards.

Table 1. Top 12 countries by participation, performance metrics

Country	Number of registrants	Number of certificate earners	Mean/SD total points for all registrants	Mean/SD hours spent on homework
United States	26309	1321	5.65 (19.33)	1.57 (5.24)
India	13044	838	7.84 (22.11)	1.56 (4.49)
United Kingdom	8430	550	7.25 (21.66)	2.07 (6.02)
Colombia	5955	458	8.93 (23.36)	2.56 (6.57)
Pakistan	4308	212	6.50 (19.36)	1.32 (4.24)
Brazil	3852	190	5.5 (18.99)	1.40 (4.72)
Spain	3684	535	14.43 (30.29)	3.25 (6.95)
Mexico	2883	150	6.28 (19.71)	1.72 (4.86)
Canada	2834	162	6.46 (20.65)	1.71 (5.45)
Russian Federation	2029	195	10.66 (26.70)	2.39 (5.73)
Poland	1392	187	14.49 (29.50)	3.18 (6.26)
Greece	1386	187	13.67 (29.73)	3.68 (8.65)

3.2. Variability in offline collaboration

In 6.002x, there was a range of student responses to the question of working with collaborators offline. While most respondents reported that they worked on 6.002x completely on their own (75.71%), a notable portion of students reported that they worked offline with another 6.002x student (17.68%) or that they worked with someone who has expertise in the content area (2.57%).

Table 2. Proportion of respondents working with collaborators offline

Working offline	Count	Percent of respondents to this question
I worked completely on my own	2359	75.71
I worked with another person who is also completing the course.	551	17.68
I worked with someone who teaches or has expertise in this area.	80	2.57
Other	126	4.04

We then conducted a one-way analysis of variance (ANOVA) of respondents' final grade in the course by the type of offline collaboration they reported. The ANOVA test showed that there were significant differences in grade by students' collaboration with others offline: $F\ (3, 3075) = 14.28, p < 0.01$. (We report both our F-statistic and p-values for each ANOVA. With the F-test, we also note the degrees of freedom based on the number of groups for each categorical survey question as well as the overall sample size for the subset of students who received that question.) Figure 2 shows variation in performance by respondents' collaboration with others offline.

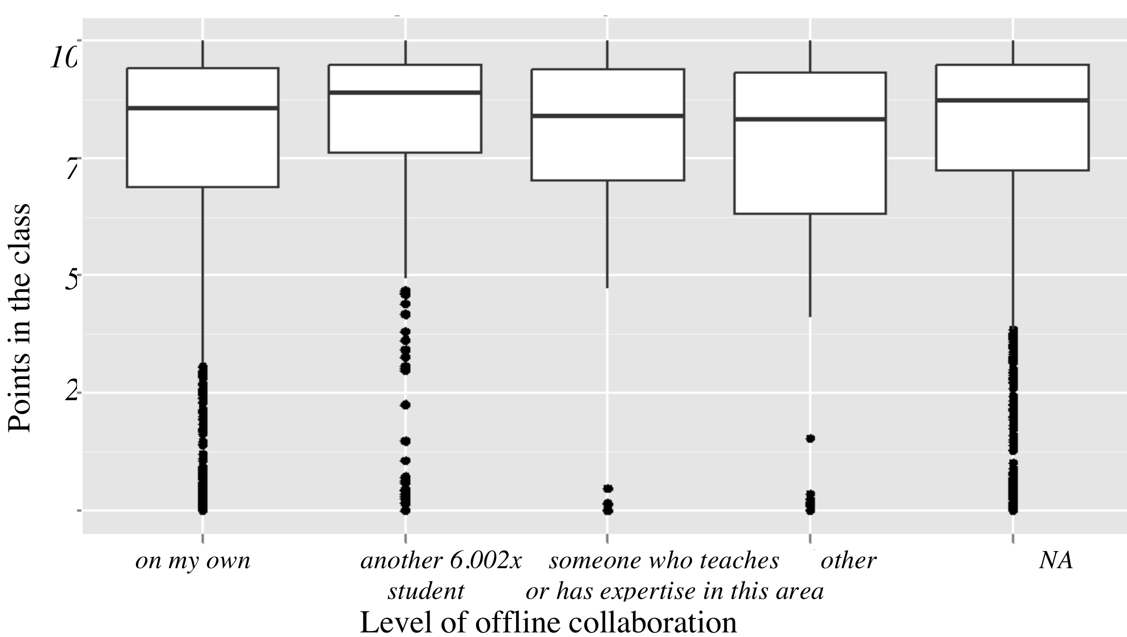

Figure 2. Performance by collaboration offline

3.3. Educational attainment

The end-of-course survey posed the question, “What is the highest degree you have completed?” Of the 2,314 responses, the highest percentage of participants (36.63%) reported having a bachelor’s degree, followed by a master’s or professional degree (27.87%), and a secondary or high school degree (26.68%). Although a statement on the course site recommended that students have prerequisite knowledge in advanced academic coursework such as an Advanced Placement (AP) level physics course in electricity and magnetism, there were still 72 of the surveyed students who reported having only attained elementary/primary school or junior secondary/high school level education, an environment in which advanced level courses were not likely to be offered. The table below shows the highest degree earned by all students who completed the end-of-course survey.

Table 3. Proportion of respondents by educational attainment levels

Degree level	Count	Percent of respondents to this question
Elementary/primary school	16	0.53
Junior secondary/high school	56	1.86
Secondary/high school	804	26.68
Bachelor’s degree	1104	36.63
Master’s or professional degree	840	27.87
PhD in a science or engineering field	178	5.91
PhD in another field	16	0.53

We then compared the overall course achievement, measured by points earned in the course, of students with the various levels of educational preparation. A one-way analysis of variance showed that there were significant differences between the mean scores of groups with different levels of preparation, $F\ (6, 2966) = 10.20,\ p < 0.01$. The group of students with the highest mean for points earned in the class was comprised of those who reported having a PhD in a science or engineering field. As might be predicted, the group with the lowest mean points was comprised of students who reported having only a primary/secondary degree prior to enrollment. It should be noted, however, that although the mean score of this group was lowest, the range of scores shows that there were individual students who performed very well. There was little difference in the mean scores of groups who reported having a bachelor’s degree, junior secondary/high school, or secondary/high school levels of preparation. The figure below illustrates the total course points earned by students with varying levels of educational preparation.

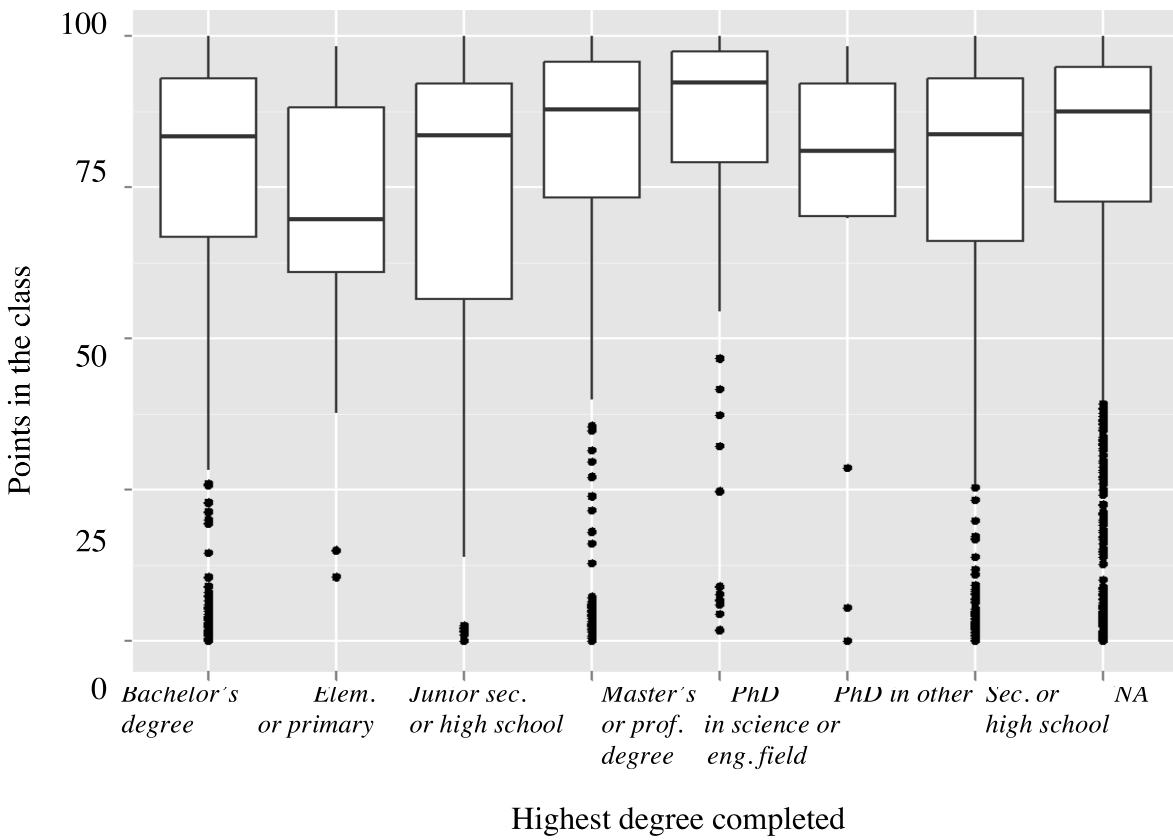

Figure 3. Performance by level of educational attainment

3.4. Content familiarity

In order to better understand the 6.002x learners' knowledge about electrical engineering prior to taking the course, we placed a question on the post-course survey that asked if they taught electrical engineering in any setting. As evidenced by the table below, the majority of survey respondents (86.61%) were not involved in teaching this subject. Two hundred and fifty-five respondents (8.80%) reported teaching electrical engineering in a college or university setting, whereas fewer respondents reported teaching the subject in other settings (2.59%) or at the high school or secondary level (2.00%). This small but important population is noted in other open online courses [3].

Table 4. Proportion of respondents by experience teaching content

Teaching status	Count	Percent of respondents to this question
I do not teach EE.	2510	86.61
I teach EE elsewhere.	75	2.59
I teach EE in college/university.	255	8.80
I teach EE in high school/secondary level.	58	2.00

An analysis of variance showed that there were no significant mean differences in overall course achievement when groups were compared using reported teaching status as the grouping factor $F(3, 2857) = 1.54, p = 0.20$. The mean course points for 6.002x students who reported teaching electrical engineering in high school or secondary school was lower than the mean for the other groups. The group who reported teaching electrical engineering in a college or university had the highest mean course points, although their scores were not significantly different from the mean of those who did not teach or reported teaching elsewhere. The figure below illustrates the total course points earned by students reporting teaching or not teaching electrical engineering.

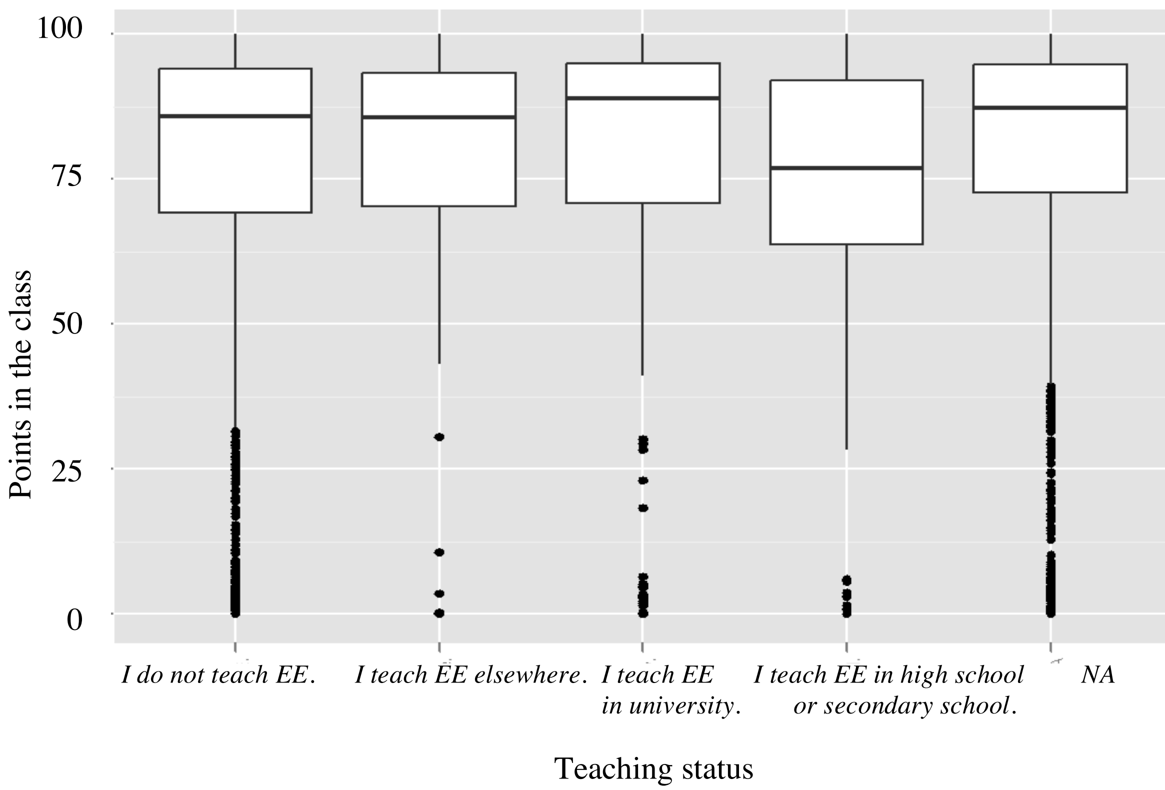

Figure 4. Performance by teaching content

3.5. Motivation for enrollment

Of substantial interest to MOOC developers and researchers trying to understand completion rates are reasons why students enroll in the course. This initial motivation for enrollment may aid in predicting how much effort students will exert in the course. For 6.002x, the most frequent response (55.41%) to the question, "What is your primary motivation for taking 6.00x?" indicated that student enrollment was driven by a desire to gain knowledge and skills, followed by a desire for personal challenge (25.58%). The option that received the fewest responses was related to gaining a social understanding and friends (0.43%). It should be noted, however, that students were limited to one selection for this question, thus limiting the responses to their primary reason. Students may have had a combination of reasons for enrolling. The table below shows the proportion of all response to this survey question.

Table 5. Proportion of respondents by reason enrolled in class

Reason given	Count	Percent of respondents to this question
Employment/job advancement opportunities	97	8.27
Other	40	3.41
Preparation for advanced standing exam	28	2.39
Social understanding and friends gained as a result of taking the course	5	0.43
The entertainment value of the course	53	4.52
The knowledge and skills gained as a result from taking the course	650	55.41
The personal challenge	300	25.58

An analysis of variance showed that there were marginal significant mean differences in overall course achievement when groups were compared using reason for enrollment as the grouping factor $F(6, 1155) = 2.07, p = 0.05$. The mean course points from students responding “knowledge and skills gained” and “personal challenge,” reasons that may be interpreted as conveying intrinsic motivation to learn, were not significantly different from the means of groups responding “employment/job advancement opportunities” or “preparation for advanced standing exam”, which may be interpreted as extrinsic sources of motivation. The figure below illustrates the total course points earned by groups by reason for course enrollment.

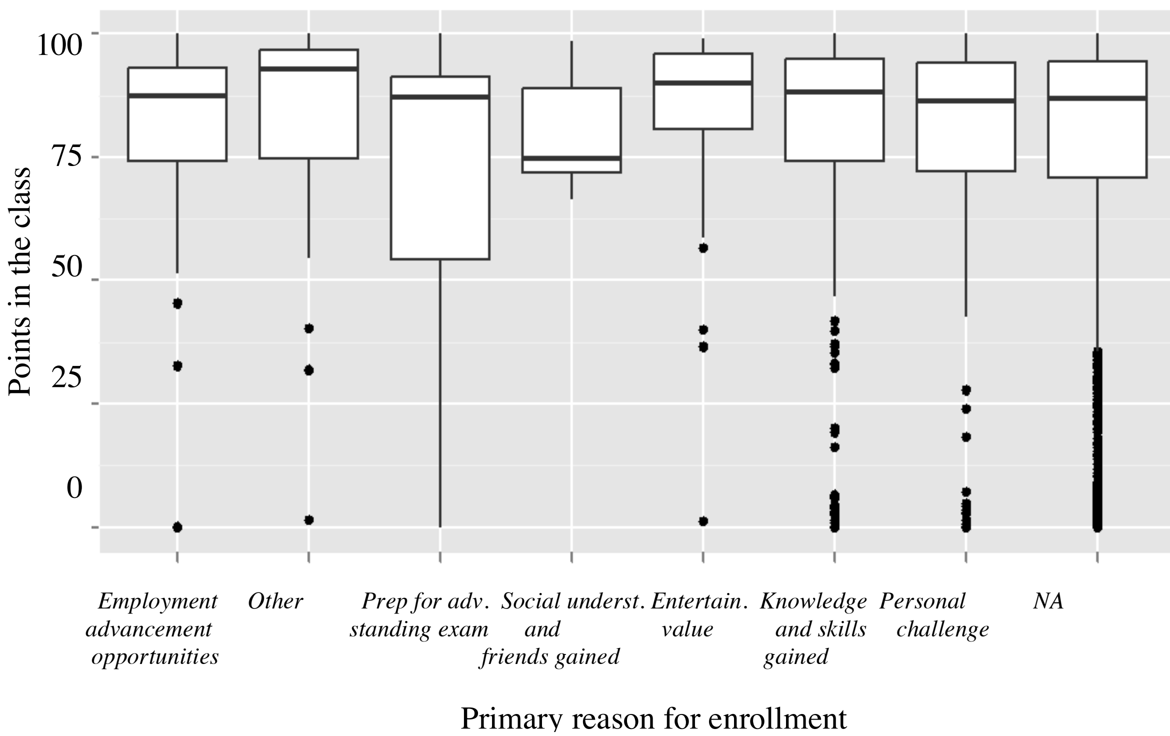

Figure 5. Performance by reason enrolled in class

4. Implications

We demonstrate that there is a high degree of variability in the backgrounds and behaviors of students in the first MIT MOOC class. Some of these characteristics also relate to notable differences in performance as well. Our descriptive work in this study serves as a spotlight on the important challenges that such a diverse classroom poses for instructors, course designers, and education researchers. In further studies, we delve more deeply into the predictors of student achievement.

As illustrated by points earned in 6.002x by students with various levels of preparation, prior educational experience was an important factor in predicting student success. Students who are less prepared may need experiences that scaffold their understanding of pivotal course concepts. It must be acknowledged that points in the class may also be a reflection of time and effort expended by students and not necessarily an indication of an increase in knowledge or skills in this content domain. However, the lower performance of 6.002x students who come in with lower educational attainment suggests that further exploration into the needs of this particular group may be warranted. Another group of participants whom we identified in this analysis was comprised of those who teach at the high school or secondary school level. MOOCs are an ideal mechanism for delivering continuing education to interested individuals, and secondary school educators may be a prime audience for this type of learning experience. It is important to note, though, that this is the first edX class, and the generalizability of results in this dynamic, early stage of MOOCs has yet to be determined.

In this study, we note that students who collaborate with others offline may do better in the class. This suggests to MOOC providers that supporting different venues for student-student interaction may help learning in MOOCs. The marginal significance of students' reasons for enrolling is also provocative. Even among the limited sample of students who continued to participate in the class through the end and who responded to the exit survey, there is a marginally significant difference in performance between students who enrolled for different reasons. MOOC providers may be able to differentially support students who register for classes for different reasons (e.g., [4]). Knowledge of prior student experiences may be a helpful piece of information for MOOC providers to support unique individuals in these new massive classrooms. In future work, we investigate the complex multivariate relationships between prerequisite knowledge, different educational experiences, and other "background" variables that characterize different groups of students, and success in MOOCS. MOOCs must clearly understand the types of students they are targeting as well as the prerequisite knowledge and experiences necessary to succeed in MOOC classes.

5. Acknowledgements

We thank MITx for data access, and MIT Professor David Pritchard and members of his RELATE (Research in Learning, Assessing, and Tutoring) group for their work in data preparation and subsequent analysis.

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The MIT LINC 2013 Conference

Parallel Presentations

Session #3
The Worldwide Development of MOOCs

- "Entrepreneurship: The First MOOC in Malaysia" presented by Muhstak Al-Atabi
- "Surviving the Avalanche: Improving Retention in MOOCs" presented by Nicholas Breakwell (Ireland)
- "Teacher Education MOOCs for Developing World Contexts: Issues and Design Considerations" presented by Clifford Omodele Fyle (Oman)
- "MOOCs Concept and Design Using Cloud-based Tools: Spanish MOOCs Learning Experiences" presented by Rocael Hernandez Rizzardini (Guatemala)
- "An Integrated Framework for the Grading of Freeform Responses" presented by Piotr F. Mitros and Vikas Paruchuri (U.S.)
- "Massive Open Online Courses: a New Window on Education" presented by Daniel T. Seaton, Yoav Berger and David E. Pritchard. (U.S.)
- "MOOC'ing in Belgium" presented by Caroline Stockman
- "MOOCs and Foucault's Heterotopia: On Community and Self-Efficacy" presented by James E. Willis, III (U.S.)

Entrepreneurship: The First MOOC in Malaysia

Muhstak Al-Atabi

Abstract

Massive Open Online Courses (MOOCs) appear to be a very hot topic in the education circles with the promise to change the world educational landscape. This paper reports on the first MOOC to be offered by a Malaysian University. The MOOC described here is a course on Entrepreneurship and it attracted very good response from students all over the world. This course is expected to inspire more interest in the MOOCs in other Malaysian Universities.

Introduction

Distance learning, where students take courses while being physically separated from their teachers for majority of the duration of the course [1], is by no means a new phenomenon. It has been delivered through mail and TV and recently through the Internet. Nevertheless, distance learning is viewed as a second option or an alternative type of education and it did not really grow to the level that it becomes a major segment of education provision. However, this may be quickly changing now. In 2011, a Massive Open Online Course (MOOC) about Artificial Intelligence offered by Stanford University attracted 160,000 students from around the world, with 23,000 of them managing to successfully complete the course, which gives a completion rate of 14%.

MOOCs are offered openly, for free, to students anywhere in the world [2]. Although the first MOOC was offered by the University of Manitoba in 2008 [3], MOOCs seem to be picking up now as two trends are converging, namely the inability of physical campuses to cater for the higher education needs of the growing world population and the maturity of the technology that makes broadband internet more accessible and reliable.

A good number of leading world universities are offering a growing number of courses to the worldwide audience and many others are seriously considering joining the movement. The MOOCs are delivered over a number of platforms, some of them are general purpose, such as Coursera, Udacity, Canvas, OpenLearning, and Course-Builder (by Google) while some are institution specific platforms such as Edx jointly developed by Harvard and MIT and Class2Go developed by Stamford [4].

This paper reports a MOOC offered by the School of Engineering at Taylor's University. This MOOC represent the first ever to be offered by a Malaysian University.

MOOCs and Malaysia

Generally speaking, Malaysia has sufficient places at the institutions of higher learning for its citizens. The country has a healthy combination of 20 public and 45 private universities as well as foreign universities campuses including the University of Nottingham, Monash University, Curtin University, Swinburne

University of Technology, Newcastle University and Herriot Watts University. As a matter of fact, the Malaysian Government plans to attract more international students to Malaysia making it a regional educational hub. A careful implementation of MOOCs can be one of the useful tools to achieve this goal as it can play a role in internationally branding the Malaysian universities as well as providing risk-free trials to interested international students who can attend MOOCs at the universities (or programmes) of their choice before registering. It is postulated here that it would be useful if Malaysian universities can offer an array of high quality MOOCs that can reflect the standards of the higher education in the country.

Taylor's University

Taylor's University is a leading Malaysian private university with more than 12,000 full time students. It is a comprehensive university offering undergraduate and postgraduate programmes in medicine, pharmacy, biosciences, engineering, architecture & design, computing, hospitality, business, law, education and communication. Taylor's University has been ranked "Excellent" by the SETARA rating commissioned by the Ministry of Higher Education (Malaysia) and it is a national leader in education innovation and quality.

Taylor's MOOC

Entrepreneurship is a course offered to engineering students at their second year of undergraduate programmes at Taylor's University. It normally has around 80 students registered and it is aimed at developing business related skills to complement the technological knowledge and skills acquired by the engineering students. The course is offered over a 14-week semester and it includes a series of lectures as well as a group project whereby the students work on developing a business idea using their newly acquired entrepreneurial skills. The course also features variety of tutorials and project pit stops where the students are given feedback and guidance on their projects' progress. The course outline is given below.

1. Why Entrepreneurship?
Entrepreneurship is the art of making the world a better place, through orchestrating various resources with the intention of creating value and enriching life. Entrepreneurship represents a set of skills that can be utilised by anyone to enhance the quality of life in both for-profit and non-for-profit contexts.

2. Think like an Entrepreneur
Entrepreneurs are very optimistic people. They see opportunities where others see problems and obstacles and they keep a rather romantic view of the world, believing that they can make it a better place. In this lecture, students will learn language and thinking skills and techniques that will help them think like Entrepreneurs, identifying opportunities and taking appropriate actions to realise them.

3. Build an Entrepreneur dream team

Entrepreneurs' goal is not fix all their weaknesses, but rather to amplify their strengths and surround themselves with people who can complement them. Building a successful team is a highly important skill and students will have the opportunity to build teams of both on-campus and online students to work throughout the semester on a project of their choice.

4. Execute like an Entrepreneur
This exercise gives the students the opportunity to work with their team members on a short project. The project needs to be completed within 24 hours. This gives you the chance to assess their skill levels as well as learn from the experience of other teams.

5. Focus like an Entrepreneur
Being able to focus one's energy and other resources on a particular project is important, especially as a new project starts. Students will work with their team members on identifying the project that that they will work on for the rest of the course duration.

6. Create Value like an Entrepreneur
Entrepreneurs create products and services that we need and desire to have at a price that we can afford. These products and services make life easier, safer and more enjoyable. They affect the way work, study and play. Entrepreneurs achieve this through creating a balance between what is technologically feasible, economically viable and humanly desirable. Through this balance, product such as iPhone are borne.

7. Mange projects like an Entrepreneur
A short introduction to project management is provided here including the use of Gantt charts and identification of critical paths.

8. Learn like an Entrepreneur
Entrepreneurs have an open mind and they are always on a learning curve. For them, life is a school and they learn most of the time from other people. In this activity, students are required to identify a successful Entrepreneur that a student knows and share with the class the reason behind the choice of that Entrepreneur and shed some light on what makes her(him) different.

9. Inspire like an Entrepreneur
Entrepreneurship is a journey that you will need to inspire people to join you on. In this lecture, students will learn the importance of well articulated Vision and Mission for a business.

10. Communicate like an Entrepreneur
Business is all about people. Whether your staff, customers, investors or the governmental officials, you will need to communicate, communicate and communicate. This lecture will provide students with a framework for an effective communication that can be used not only in business context, but in life at large.

11. Sell like an Entrepreneur
Understanding markets and marketing is an important skill for an Entrepreneur. This lecture will introduce students to the essentials of marketing.

12. Manage risk like an Entrepreneur
While Entrepreneurs are optimistic, they also have balanced view of the world. They have two antennas, one seeking opportunities and the other sensing for associated risk. Students will be exposed to different techniques that they can use to protect their business activities.

13. Be a global Entrepreneur
Entrepreneurs realise that the world is their staff recruitment field, source of raw materials and market. Hence a global attitude is very important for an Entrepreneur. This lecture will expose students to the global dimension of Entrepreneurship.

The author is the course leader for this MOOC and currently he is the dean of the school of engineering at Taylor's University. It is hoped that this MOOC will inspire other Malaysian universities to follow suit and offer high quality MOOCs that will be reflective of the standards of higher education in the country. Once this MOOC is concluded, reports about its design and performance will be made available to both institutions of higher learning and the officials of the Ministry of Higher education. The authors intend to report on the level of success of the MOOC in terms of students' numbers, countries, as well as the percentage of successful completion of the course. Qualitative data on the students learning and experience will be gathered, shared and analysed as well.

Converting the Course into a MOOC
This module is offered as a MOOC and will start on 27 March 2013. The platform selected to deliver the MOOC is OpenLearning. OpenLearning provides many social media like features such as forums to enable students to comment and receive comments encouraging interaction while learning. OpenLearning has other interesting features such as karma points, which are gained via obtaining positive comments from peers, and badges that can be issued either automatically or when a certain learning goal is achieved. These features, together with a life progress bar, are designed to encourage learning and collaboration throughout the course.

Within 20 days of the announcement of the course online, more than 500 students from 75 different countries registered for it. This is a far cry from the 160,000 registered at Stamford, but nonetheless is a promising start. As a matter of fact, having a relatively smaller class size can be a positive thing to enable the course coordinators to give more support to the online students and hopefully resulting in a better successful completion ratio.

All the online students will need to watch all the recorded lectures and complete all the assignments and other activities of the course. The key component will be that the online students will need to complete the group project as well. The on campus students are required to 'recruit' online students on their teams. Online

students will need to build their teams as well. Keeping up with different course milestones will be very important. Once the team's project is on track, it is hoped that the online students will be motivated to complete the course as their commitment is not only important for their success but also to the success of their team members. The course is available at:
https://www.openlearning.com/courses/Entrepreneurship

Conclusions
This brief paper reports on the first MOOC in Malaysia offered by the School of Engineering at Taylor's University. The initial response, from participants around the world, was very encouraging to say the least. This course will be delivered and closely analysed and its information will be shared especially with other Malaysian institutions of higher learning.

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Surviving the Avalanche: Improving Retention in MOOCs

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Abstract

MOOCs (Massive Open Online Course) bring together, for the first time, high quality "ivy league" providers, online education and a low-cost model. The evidence to date, however, strongly suggests that any reasonable measure of learner engagement in MOOCs is underwhelming. This paper describes a model of online content development and delivery, known as COACT, which aims to ensuring that higher-order learning and reflection is embedded within the learning process and that, as a result, learner engagement is enhanced. The paper reports on the development and delivery of Ireland's first MOOC, "Exploring Irish Identity" using the COACT framework and will explore whether MOOC content developed in this format can improve learner engagement and retention.

A recent paper written by Sir Michael Barber, Katelyn Donnelly and Saad Rizvi and published by Pearson Education declared, "An Avalanche is Coming". The paper addresses the challenge faced by higher education globally to address the needs of 21st Century learners and to deal with the threat of new technologies and new ways of engaging with higher education. Perhaps foremost amongst these threats to traditional campus-based provision is the threat of high quality higher education delivered online and for free.

The MOOC (Massive Open Online Course) is the new darling of distance education, bringing together, for the first time, high quality "ivy league" providers, online education and a low-cost (for participants although not necessarily for the institution) model. Three MOOC platforms are leading the race, Coursera, Udacity and EdX. All three are associated with the highest ranking U.S. Universities and Coursera has gained most attention so far. Coursera now offers over 200 courses from 30 different Universities, including two in the United Kingdom (University of London and Edinburgh) and has over 1 million registered users. EdX represents a collaboration between Harvard and MIT and Udacity, like Coursera, started at Stanford. In the U.K. in February, the Open University announced a UK-centric MOOC platform in a collaboration with a number of other UK Universities.

MOOCs align with the approaches to teaching and learning advocated by the Kronberg Declaration (UNESCO, 2007), whereby learners ‘play an ever more active role in knowledge acquisition and sharing’ with ‘the role of teachers and instructors decreasing’. While on the one hand the basic design of individual MOOCs so far may not have moved too far beyond traditional pedagogical approaches, being largely lecture-based in format at the moment, the concept itself is learner-centred, liberating students to access and engage with education as it is needed, on subjects identified by the individual as useful in their own particular context. Also, by their very scale, MOOCs shift the focus from teacher to learner. In such a way, by moving towards more self-driven learning, arguably we move away from 'banking' approaches to education whereby knowledge is deposited in passive students, towards more 'problem-posing' education, and the resulting 'emancipation' that can bring (Freire, 1970). Furthermore, Bauman's (2003) vision of a fluid, ever-changing world in which education needs to become a 'process' as opposed to a 'product' carries particular resonance in the context of MOOCs, where MOOCs can potentially provide rapid access to knowledge on an 'as-needs' basis, regardless of previous qualifications or status.

However, to date, it would appear that MOOCs are failing to live up to these lofty ambitions for a radical shift in the way that undergraduate education is delivered. The evidence to date strongly suggests that any reasonable measure of learner engagement in MOOCs is underwhelming when compared to the massive number of enrolments that many have secured. For example, a paper from Duke University describing the development and delivery of a Bioelectricity MOOC reveals that only 4.41%% of enrolled learners were still engaged after four weeks, as measured by scoring greater than zero in a online quiz. Similarly at Edinburgh University, large enrolments quickly whittled down to admittedly large, but certainly not massive, classes of engaged learners after only three weeks.

There are many explanations for this massive attrition rate and high on the list for sure is the pop status that MOOCs are currently enjoying. But another reason may well be the rather traditional behaviourist approach to online learning that many MOOCs have so far deployed. A typical MOOC session on Coursera, for example, consists of a pre-recorded talking head, usually in 15-30 mins bite size chunks, a self assessment quiz and a discussion forum, moderated with a light touch if at all. Thus far MOOCs have not, on the whole, been an advertisement for highly engaging, task driven learning which encourages learners to seek meaning through interpretation and abstraction. This paper describes an attempt to develop and deliver a MOOC that does offer learners the opportunity to deeply engage with the learning materials with the hypothesis that this engagement will affect attrition rates.

Hibernia College employs an online content development framework known as COACT for the development of the learning materials for its initial teacher education (ITE) programmes. The COACT model is a theoretical framework that forms the basis of lesson design and structure, with a view to ensuring that higher-order learning and reflection is embedded within the learning process. The framework builds on Säljö's hierarchy of learning and subsequent work by The Goteburg Group (Gibbs et al.,1982) and the ETL Project at the University of Edinburgh (Enwistle, 2004). COACT also draws upon and extends instructional methodologies typically used in the the K-12 classroom such as the 7-Es method as described by Bentley et al (2007), adapting some of these techniques both to the online environment and for post compulsory education.

The definition of the word 'CO-ACT' is at the heart of the student learning experience: COACT = 'CO': 'together' + 'ACT': 'to take action, do something'. This definition, upon which the framework is based, represents a mutually constructed, active approach to learning. The model breaks the learning experience down into a five-stage process, as shown in Figure 1. These five stages reflect a progression from lower-order towards higher-order learning, towards 'seeking meaning' through interpretation, critical analysis and the application of knowledge.

Figure 1 Stages of the COACT framework

The COACT model adopts a social constructivist approach to the development of online courses. Within such approaches, the focus for the teacher is on facilitation of the *process* of knowledge acquisition by learners, rather than the more didactic approaches that emanate from the cognitive or behaviourist methodologies. This facilitation occurs through a process of what Wood, Bruner and Ross (1976) refer to as scaffolding, providing just enough support for learners to construct knowledge for themselves. Within the COACT approach to online course development, the goal is to carefully structure the lesson design to provide the necessary scaffolds to enable learners to progress through each stage.

Central to social constructivism is the notion of the learning community. As Garrison and Arbaugh (2007) note, learning communities are 'essential to support collaborative learning and discourse associated with higher levels of learning'. Moreover, Garrison and Anderson (2003, p52) contend that e-learning has the 'unique potential' to create such communities. As we will see below it is only within the context of the learning community that the Active Discovery, Critique and Think phases of the COACT model can fully be realised.

The COACT lesson design process aims to create a series of detailed plans that identify the main learning outcomes that a learner should achieve and the tasks they must work through in order to help them cement their knowledge and achieve those outcomes. Tasks can be anything from watching a video, writing a blog post, researching a topic or discussing a question that has been posed on the forum. For the Concept and Overview phases, learners are given all the learning materials they need and guided through them by their teacher – the author of the lesson. In the Active Discovery phase, they may be required, with guidance, to seek out information for themselves and share it with their classmates, through use of the class forum. The goal is to support learners to become more self-directed, able to find and evaluate information for themselves. The Critique and Think phases move the learning into the realm of higher-order thinking. Critique centres around tasks that require learners to assess, evaluate and analyse aspects of the knowledge gained in the previous phases. Think requires them to reflect on how what they have learned may apply to their classroom practice.

The COACT framework was first employed in 2011 and early results are extremely encouraging. We compared student feedback and grades across two cohorts of graduate students enrolled on the same ITE programme for primary school graduate students teachers. The Feb 11 cohort studied 'Psychology of Education' developed and delivered in a pre-COACT format, consisting of material presented in a format very similar to that described above as being the predominant format for MOOC delivery today. The Sep 11 cohort studied the very same core content, facilitated by the very same tutor team, but with the content re-designed within the COACT framework.

Using the Net Promoter Score (NPS) which asks "Would you recommend this course to a friend" as an overall satisfaction measure, the Feb 11 group scored -14, whereas the Sep 11 group scored 27. Time on task was higher for the Sep 11 group, with 81% of the Sep 11 cohort spending 6 hours or more time on task per week, compared with 54% in the Feb 11 group. Sep 11 were somewhat more satisfied overall with the course (95% rating the course as good or excellent, versus 92% of the Feb11 cohort), but more interestingly, the Sep 11 cohort rated the tutors' performance significantly better than the Feb11 cohort did with 96% rating tutors as good or excellent compared to only 83% in the Feb11 cohort. This increased satisfaction with tutor performance held across each of the sub-category questions including: performance as an effective facilitator, level of subject knowledge, accessibility during the course, overall academic and professional performance, tutor responsiveness to postings and emails and level of tutor and learner interaction during online tutorials.

This increased satisfaction with tutor performance is the more surprising given that the tutor team (12 individuals each facilitating one or more groups of c.25 students) were exactly the same for the Feb11 and Sep11 cohorts.

This finding strongly suggests that a model of online content development and delivery that is specifically designed to encourage interaction, or COACTion, between learner and facilitator and between learner and learner, can significantly enhance students' impressions of tutor interaction and tutors' teaching quality. For instance, it is highly unlikely that the tutors enhanced their levels of subject knowledge in between the delivery of this module to the two cohorts, yet 97% of the Sep11 cohort rated tutor subject knowledge as good or excellent compared to 91% of the Feb11 cohort.

A feeling of isolation, lack of opportunities for meaningful interaction and lack of peer pressure are often quoted as reasons that may explain lack of progression for online learners. This failure to engage may also, at least partially, explain the massive attrition rates in MOOCs which begs the question of whether or not a more engaging method of content development and delivery, such as the COACT framework, can improve progression and completion rates in MOOCs and thereby help deliver on the potential that massive open online education offers the global higher education market.

On March 20th, Hibernia College announced Ireland's first MOOC, "Exploring Irish Identity" (see http://mooc.hiberniacollege.net). It has been developed in partnership with "The Gathering", a Tourism Ireland initiative to drive tourism to Ireland in 2013 with a particular focus on the Irish Diaspora. Scheduled to begin in late May, this MOOC will be developed within the COACT framework. It will be an eight-week programme considering the notion of Irish Identity through an exploration of:

1. **Irish History**
2. **Irish Literature and Theatre**
3. **The Irish Language**
4. **Irish Film**
5. **Irish Art**
6. **Music and Dance**
7. **Sport**
8. **Landscape**

It is our expectation that the vast majority of learners in the MOOC environment, who are not motivated by the desire to obtain a professional qualification as are our ITE student, will not naturally be inclined to participate at a deeper level than that offered in the Concept and Overview phases. We are hopeful, however, that through the careful construction of learning tasks that are designed to foster engagement, we can encourage students to participate in the

Active Discovery, Critique and Think phases, thus helping them derive maximum educational benefit from the experience and encouraging them to remain active participants in the course. A progress report on the success of this MOOC will be provided at the conference with a focus on the key attrition metric of engaged learners at the end of week three of the MOOC.

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Key words: MOOC, massive open online course, irish identity, attrition, progression, completion, Ireland, COACT, Coursera

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Teacher Education MOOCs for Developing World Contexts: Issues and Design Considerations

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Abstract

There is a massive shortage of teachers worldwide. This shortage is particularly acute in developing countries. Distance-oriented education has been hailed as one of the possible solutions for resolving this problem. In recent years, new generations of Web-based distance-oriented education models have come to the fore; the latest of which are MOOCs. In this paper, the issues and design consideration for MOOCs will be discussed. These include the pedagogical affordances that MOOCs must have for their successful contribution to teacher education, the suitability of MOOCs for teacher education in developing world contexts and the technological affordances vis-à-vis the needs of the learner, existing technological infrastructures, and e-learning readiness skills.

Background/Introduction

According to a UNESCO monitoring report, by 2015, the world will need at least an additional 2.6 million teachers in order to ensure that every child receives a primary school education [1].

This need for teachers is most acute in developing countries in sub-Saharan Africa, the Arab States, and South and West Asia.

In order to meet these massive needs, distance-oriented education [2] [3] including various technology-enhanced models, methods, and modes [4] have been put forward as possible solutions. Specifically, mobile technologies, and web-based models that include computer-mediated communication platforms, webcasts and webinars, OERs, and online courses are examples of the most recent generation of these models.

Notably, over the past few years, Massive Open Online Courses (MOOCs) have been gaining attention as a disruptive force that could change the face of higher education around the world [5]. In addition, their promise as well implications and possible usefulness for education in developing countries has received considered attention [6] [7].

However, the design, development and facilitation of MOOCs are still in the early stages and what constitutes a successful and effective MOOC has still yet to be determined. So, the purpose of this paper is to contribute to the discourse by focusing on the issues and factors that should be considered before and during the design of teacher education MOOCs for use by learners in developing countries. First, MOOCs in terms of the required pedagogical affordances for effective teacher education will be discussed. Second, the various types and levels of teacher education will be reviewed in light of the appropriateness of MOOCs as learning and teaching platforms. Third, the technological affordances of MOOCs and their suitability for teacher education in developing world contexts will be examined.

MOOCs and the required pedagogical affordances for teacher education

The pedagogical affordances of MOOCs can be described as those “unique features sets and characteristics” they encapsulate that “add value to the learning experience, over and above what might be expected without the technology" [8]. In order to understand these affordances, it is apt to review them within the contexts of what constitutes a good teacher preparation program and the attributes a good teacher must have. In this regard, in a recommendation concerning the status of teachers, UNESCO and the ILO adopted a recommendation on the status of teachers that outlined the various elements of a teacher education preparation program [9]. These elements include general studies, the main elements of philosophy, psychology, and sociology as they apply to education, the theory and history of education including comparative education, experimental pedagogy, and school administration and the methods of teaching various subjects. In addition, students should undergo studies related to their intended fields of practice, and engage in the practice of teaching and conducting extracurricular activities under the mentorship of fully qualified teachers. With respect to what constitutes good teaching, after a review of the literature, Burns [4] outlined five attributes of a good teacher, which tally well with the UNESCO/ILO recommendations. These include a strong level of domain content knowledge, the adoption of a structured approach to instructional activities, a strong pedagogical content knowledge, having knowledge of how students learn, and having a strong sense of self-efficacy.

So, MOOCs must afford learners in teacher education programs the features, tools, resources and interactions that will enable the acquisition of the various aforementioned elements of good teaching. These can be outlined as follows:

1. MOOCs must be able to facilitate the acquisition and mastery of domain content knowledge that includes general education as well as focused knowledge of a student's major specialism.
2. MOOCs must facilitate the acquisition of knowledge skills related to the design and delivery of structured instructional activities.

3. MOOCs must provide opportunities for students to reflect on both the knowledge and skills they acquire, and on their in-the field teaching practice experiences.
4. MOOCs must provide a platform for social interactions between learners and teacher educators, practicing teacher mentors, other experienced teachers, and their peers.

The appropriateness of MOOCs for different categories of teacher education

Teacher education is a complex business that requires a multifaceted and multi-layered approach due both to the many different learning needs of the world's children as well as the diverse set of competencies that need to be acquired by teachers. In order to determine the appropriateness of MOOCs for teacher education, it is first necessary to delineate the various types and categories of teacher education specifically as they relate to developing world contexts. Perraton [3], in a report on the role of open and distance learning in teacher education, categorized teacher education into initial training and continuing professional development.

The initial training of teachers could take the form of either pre-service or in-service teachers [3]. Pre-service teachers requiring initial training would be those that have had no training prior to getting a job as a teacher in a school. In-service teachers requiring initial training on the other hand are those individuals who already have jobs as teachers, but who never had any initial formal training as teachers. The continuing professional development of teachers can be categorized into teachers who already have a teaching qualification but need upgrading, teachers who need reorientation education due to curriculum change, and teachers' career development.

The appropriateness of MOOCs as teaching and learning platforms for teacher education would depend on how it is being used to support the various types and levels of teacher education. For example, the current design of MOOCs that use various content presentation and automated assessment methods would lend themselves well to the acquisition of content knowledge required in both the initial training and aspects of the professional development of teachers. Peer assessment methods currently being used by MOOCs such as Coursera could also work in the acquisition of skills related to the design and development of instructional activities required for teachers in initial teacher preparation programs. However, the assessment criteria and peer pairing would have to be carefully thought out with an additional component of teacher-educator mentors monitoring the quality of the products being designed and developed. The challenge arises in figuring out effective and efficient ways to reinforce various aspects of the in-the-field teaching experiences required for initial teacher preparation programs within the MOOCs. Reflection pieces and field reports could be peer-assessed but the most effective feedback would come from experienced teacher educators. The review and provision of such feedback would not lend itself well to automated methods.

The same issues arise with the supporting of various aspects of the continuing professional development of teachers. Successful teacher professional development requires a social and community-centered approach [10] [11] [12]. According to Barab et al. [10] this approach should foster a culture of sharing and provide sustained support for teachers as they review and reflect on their beliefs and practices. Teachers for instance needing reorientation education due to curriculum change may have belief and conceptual change issues that may need to be addressed. These require sustained interventions and can take time, sometimes months and years to bear results [13] [14]. Target teachers may need to be continually presented with the new concepts and content in different ways over a period of time before they begin to experience a disconnect between their current beliefs and this new information [15] [16].

According to Gaible and Burns (17), teacher professional or career development (TPD) can be categorized into standardized TPD, site-based TPD, and self-directed TPD. Standardized TPDs invariably include the use of training-based approaches where knowledge and skills are presented via face-to-face, broadcast, or online modes. This model is useful for exposing teachers to novel ideas, concepts, and instructional methods. Site-based TPDs invariably occur in schools, resource centers or teacher education colleges. They include the use of facilitators or master teachers and are useful for mastering pedagogic content and technology skills, and focusing on specific issues that teachers encounter in their particular schools or local environment. Self-directed TPDs entail teachers specifying their individual professional goals and selecting the plans and activities that would enable them to achieve those goals. The scope of self-directed TPDs varies depending on individual teacher needs. However, they are most useful to more experienced teachers who have a desire to augment and enrich their knowledge and skills than to less experienced teachers requiring basic or intermediate knowledge and skills.

In terms of their current designs, the appropriateness of MOOCS for teacher professional development related to career improvement would depend on what elements of the different categories the focus is on. While they could be used to serve elements of the three categories of TPD, MOOCs would best lend themselves in terms of usefulness to facilitation of standardardized TPDs and certain aspects of self-directed TPDS and less so to site-based TPDs.

In order for MOOCs to fulfill the need for social interaction in communities that include teachers, their peers, teacher-educators and mentors, the parameters of current MOOC designs would have to be extended. In other words, MOOCs designed for teacher professional development would have to include more sophisticated online forums and other technology-oriented social structures and features that would support effective forms of social-constructivist learning. In addition, the standard course design structures and their embedded instructional strategies would need to be adjusted to support the learning that can only take place over longer periods of time with sustained interventions.

The technological affordances of MOOCs and their suitability for teacher education in developing world contexts

The suitability of MOOCs in terms of their technological affordances for developing world contexts depends on the needs of the learner, the technological infrastructure in his or her location, and the preparedness of the learner in terms of the requisite e-learning readiness skills. The needs of the learner depend on the type and nature of knowledge and skills he or she requires. Certain types of knowledge and skill acquisition lend themselves better to MOOCs than others in terms of efficiency and effectiveness. For example, the acquisition of foundational conceptual knowledge and skills during a pre-service teacher preparation program could be totally carried out through an MOOC. These could be delivered through videos, and in text and audio formats through the Web. Conceptual knowledge and skills could be reinforced and assessed in a variety of ways using automated formative and summative assessment tools, peer assessments tools, and discussion forums, chat rooms, etc. However, the acquisition of practical in-classroom skills necessitates that teachers spend substantial amounts of time out in the field in actual schools. These practical skills require substantial interaction between the trainee teacher and students and trained teachers in the physical school classroom. Some of this skills training could be reinforced through activities that take place in an MOOC. It could take the form of interaction with more experienced teachers, mentor teachers and teacher educators who comment on trainee teacher reflections and have engaging and fruitful dialogues on their in-the-field classroom experiences. However, this component of learning and skills reinforcement of practical in-classroom skills acquisition in the MOOC would not suffice.

The application and use of MOOCs by learners depend on the nature and sophistication of technological infrastructure in place in his or her location. MOOC providers, Edx.org (Edx.org Help page) and Coursera.org (Coursera.org Help page) simply state that the requirement for participation in their MOOC is access to an Internet connection. Udacity.com (Udacity.com FAQs) however provides more detailed general technical requirements stating required browser versions and Internet connection speeds, computer operating systems minimum specifications, as well as specific ones for activities such as the playing of videos and online proctoring. So, in general it can be safe to say that in order to participate fully in an MOOC regardless of the provider, the learner must have access to technology that meets certain basic specifications. These include having access to a computer device (desktop, laptop, tablet, mobile), having a computer device that has browsing software and word-processing software for courses that require this, and having access to an Internet connection with reasonable download and upload speeds. In other words, for active participation in MOOCS, a learner anywhere in the world must have a fairly up-to-date computer device and access to some form of broadband Internet.

However, it is important to note that the quality and sophistication of the technological infrastructures available to learners in developing contexts is still very limited. In addition the level of ICT penetration is still very low [18]. As of 2011, the fixed (wired)-broadband subscription rate in countries under the developing world umbrella was only 4.9 percent. For active mobile-broadband subscriptions in 2011, the rate of penetration was only 8.5%. In addition, the percentage of households with Internet access in the developing world was only 20.5%. This means that the a teacher education MOOC would be out of the reach of a substantial number of teachers in the developing world, particularly those who are located in the “least developed countries” of the world [19] where even for those who could afford to purchase or have access to computer devices, broadband infrastructures may not exist, or in many cases will be patchy.

The preparedness of the learner in terms of the requisite e-learning readiness skills is also an important factor for successful learning and participation in MOOCs. After a review of the literature, Dabbagh [20] outlined a number of attributes a successful learner should have to participate in e-learning environments. He or she should be skilled in the use of online learning technologies, particularly communication and collaborative technologies; have a strong academic self-concept and good interpersonal and communication skills; have a basic understanding and appreciation of collaborative learning and develop competencies in related skills; acquire self-directed learning skills through the deployment of time management and cognitive learning strategies.

In sum, even when learners in developing countries have access to required technological infrastructures, they may not have the requisite aforementioned e-learning readiness skills that will enable them to participate fully in MOOCs. And the reason for this is due to the limited exposure and experience of these learners to the Internet and specifically e-learning environments compared to their counterparts in developed countries.

Conclusion

The knowledge, skills, and attitudes that teachers need to acquire throughout their lifetime training and professional development as teachers is complex. As a result, when designing MOOCs for teacher education care must be given to selectivity regarding what is most effective to be taught and its fit with existing teacher education programs. Also, in this regard, there are various issues and design considerations that must be made during the possible design of an MOOC for teacher education that will be of benefit to learners in developing world contexts. A successful design would need to incorporate features and tools that would harness research proven pedagogical principles. Consideration would also need to be given to the appropriateness of MOOCs for different kinds of teacher education. The acquisition of particular kinds of knowledge and skills can be achieved much more efficiently and effectively in MOOCs than others. In addition, the learners' access to the most appropriate technologies, as well as their preparedness in terms of the required e-learning competencies must be studied as these may vary from one developing world context to the other.

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MOOCs Concept and Design using Cloud-based Tools: Spanish MOOCs Learning Experiences

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Abstract

New forms of education and media technologies as well as the availability of affordable devices, free services and open content have strongly influenced modern learning settings. The advent of open courses have demolished organizational restrictions and dramatically increased the number of participating students. MOOCs have become increasingly popular. This situation has motivated research and development of MOOCs making use of cloud-based learning tools and online tools as well as learning support specifically for Spanish speaking learners. Experimentation and findings from two MOOCs experiences have shown promising results in terms of motivational, emotional and educational aspects. On the negative side there is still a high dropout rate and challenges with interaction and collaboration among peers.

1. Introduction

Over the last decades, technological developments have significantly changed and influenced the way society access, communicate, collaborate and share knowledge. Given the demands of competing work and life balance and the commitment to life-long learning, today's generation of learners expect flexibility in accessing quality education. Modern pedagogic practices integrating socio-cultural approaches to support learners in a rich learning environment must be considered to ensure positive learning experiences and outcomes. Modern information and communication technologies and tools such as Web 2.0, Learning 2.0, cloud-based learning tools, open content and open source learning tools have all provided the ground for innovative and affordable learning settings [7];[2];[10]. As a consequence of these technological affordances, many learning institutions have begun to address the 'learning in demand' stance by introducing open online courses that can be accessible by learners from all over the world.

Early examples were Galileo University in Guatemala with Rocael Hernández Rizzardini and colleagues offering a course on 'Creating Webpages' to some 800 participants in 2005 [9]. In 2007, David Wiley at Utah State University offered the 'Introduction to Open Education' course [13];[18], and George Siemens and Stephen Downes ran a 'Connectivism and Connective Knowledge' to some 2200 participants in 2008 [15]. The large number of participants has motivated the term *MOOC* which stands for *Massively Open Online Course* [4];[6];[9];[13]. The characteristics of a MOOC can be summarized as open and free of charge, active involvement and participatory and the contributions are shared for the learning community, and the communication and collaboration tools and resources are widely distributed. Two types of

MOOCs can be distinguished as *cMOOCs* which are based on connectivism and networking, and *xMOOCs* are based on behaviourism [13];[14].

The literature reveals that the advantages of MOOCs include accessibility to courses regardless of the social and cultural background allowing participants to connect with a diverse learning group of learners [4];[6];[12]. MOOCs support self-regulated learning with a multitude of learning tools allowing participants to access, collaborate and contribute to the learning. The disadvantages include the feeling of isolation and disconnection, high dropout rates, insufficient support in the learning activities and restrictions to simple form of assessment rather than providing feedback and guidance [4];[6];[12];[14];[15];[17]. The literature highlights continual effort is required for educators to design MOOCs with access that requires facilitation involving large-scale interaction and feedback. This situation has motivated collaborative research between institutions from three countries: Curtin University of Technology, Australia; Graz University of Technology, Austria and Universidad Galileo, Guatemala.

This research is focused on providing tools for learners to collaborate, interact, and learn in a MOOC environment. This involves using cloud-based learning tools and online tools. This paper describes the MOOC experience which was specifically set up to support a group of Spanish speaking learners with little or no English literacy. The paper is organized as follows: Section 2 presents the pedagogical approach of the MOOCs. Section 3 outlines the MOOC learning environment and tools used to support the learning process. Section 4 discusses and reports on the learning experience followed by a summary and future work in Section 5.

2. Pedagogical Approach and MOOC Design

The MOOC learning environments presented in this paper were based on literature survey and previous MOOCs experiences at Galileo University [9]. In this paper, we focus on two free open courses that were offered by Galileo University to Spanish speaking learning community. Both courses *Introduction to e-Learning* and *iPhone Development* were strongly influenced by MOOC sites such as Coursera (www.coursera.org) and Udacity (www.udacity.com), and a MOOC on "Artificial Intelligence" by Norvig and Thrun [3]. Considering the differences between xMOOC and cMOOC [5];[15] and with reference to the Stanford experience [16], we chose to use xMOOC as this format promotes a teaching model emphasizing 'cognitive-behavioral' which has more of a traditional approach to online learning. The content was designed and developed in Spanish in order to reach a large amount of Spanish speaking participants from the Iberoamerican region. Both MOOCs were built on the .LRN learning management system and utilized different cloud-based learning tools (see Table 2). An overview of the main aspects of the two MOOCs is provided in Table 1.

MOOC Learning Experience	**(a) Introduction to e-Learning**	**(b) iPhone Development**
Learning and instructional objectives	Understand the e-Learning fundamentals, the related technology concepts and tools, and apply these knowledge by designing and creating an online course	Learn how to develop applications for the iOS platform including iPhone, iPad and iPod Touch international quality and develop applications to the App Store
Number of learning units	4 units (1 unit per week, 4 weeks in total)	15 units (10 weeks in total for the course)
Collaboration type	Non-guided discussions. Question and Answers (Q/A) forums.	Non-guided discussions. Question and Answers (Q/A) forums.
Assessment type	Peer assessment	Peer assessment

MOOC Learning Experience	(a) Introduction to e-Learning	(b) iPhone Development
Final product	Create an Online Course	Develop Application for iPhone
Course offered	October 2012	June 2012
Tutors	2	4
MOOC pedagogical approach	xMOOC (cognitive-behavioral teaching model)	xMOOC (cognitive-behavioral teaching model)

Table 1. General description of MOOCs

Based on the xMOOC approach of a cognitive-behavioral teaching model, the MOOCs learning experiences were designed with a semi-autonomous self-guided and individual learning approach. Each course was organized with a set of learning units, one or more units and topics for each week, and the course organization schedule was on a weekly basis. This included learning content and assignments as well as peer discussion and assessment activities. For each topic, short videos representing the main resources of the learning content were recorded for the learners. Complementary readings of pre-selected documents and hyperlinks were made available to the participants. Given that both courses require the use of software or learning tools in the cloud, a set of tutorial videos and written instructions were created to support students to complete their assignments.

Special focus was given to peer-assessment and online collaboration through discussion forums. To overcome the problems of fragmented communication channels, the communication facility was restricted to only one tool to ensure a simple way of communication. The online collaborative forums followed a gamification [11] approach. Badges were used as electronic rewards for students based on their contributions to the course learning community. A quantitative method was also used where a summative course value was earned by the student. This was based on the overall contribution and performance on questions asked and answered, the responsiveness and the most valuable contributions by the students, all rated by the learning community. This setting was selected with the intention to ensure students' active involvement and to also overcome the issue of lurking. Two tutors were available for the e-Learning Introduction course and four tutors for the 'iPhone Development' course. The duties of the tutors include monitoring and helping learners through the forums, raising community awareness of key concepts, asking common and critical questions, and making sure that the communication flows of the contributions. The tutors also moderate where required.

A rubric was created for each learning activity and students used the rubric to assess their peers. To students had to first of all complete their own assignment before assignments were randomly chosen for a blind peer-assessment process. The participation and the level of quality contributions of the peer-assessment were counted towards the course grading.

At the beginning of each MOOC, an adaption and introductory week was given to students to familiarize themselves to the learning environment and understand the overall course structure, concepts, expected performance and learning activities. The students were also required to set up their workspace at home and obtained the required tools. Every learning unit had a set of instructional objectives and learning activities, and students were expected to complete a set of assignments. All assignments had a summative value. The mastery of the units was determined by a successful completion of all the assignments and positive peer-assessment.

Previous experiences on offering online courses to a large scale of audience and the literature supported the idea of using a limited number of cloud-based tools for learning activities. To ensure the education objectives and interaction among students-to-students and tutors-to-students were met, only a set number of tools was allowed to complete the learning task. The selection of cloud-based tools was based on the digital classification of Bloom's taxonomy [1] which described a mapping from different thinking skills orders to digital tools. To this, we added the instructional and learning objectives with learning activities and the corresponding cloud-based learning tools. A summary of activities and tools and the application in the MOOCs are given in Table 2.

Instructional Objectives	**Activity and Cloud-based Tools**	**MOOCs**
Content acquisition	Videos and documents access by .LRN[1]	(a), (b)
Demonstrate an understanding of unit contents	Summarize in a word processor	(a), (b)
Structure for knowledge representation	Mind-map creation using Mindmeister[2]	(a)
Create their own LMS	Basic configuration at LMS instance at Milaulas[3]	(a)
Analyze, evaluate: organize, outline, structure the concepts of an LMS, the learning-teaching process, critically evaluate different types of LMS	First, create a mind-map using one mind mapping tool: Mindmeister, Cacoo[4] , Bubble.us[5] Second, create a presentation and publish using Slideshare[6]	(a)
Create, analyze: outline, design and produce online learning units using the guidelines provided for high quality e-learning courses.	Mind-map of student's first learning unit built using Cacoo and then create actual learning unit filling word processor templates. Learning activities designed and built with Educaplay[7]	(a)
Create, produce the online course based content templates, design and build a new introductory unit that includes a welcome video-message.	Using the LMS instance at Milaulas	(a)
Be familiar with objective C programming language and syntax and explore the initial Xcode templates that are provided for development. Learn how to create properties, classes, methods, objects and see how they work. Comprehend that the data source must respond to a specific set of messages. Recognize the importance to be able to define a set of behavior that is expected of an object in a given situation. Learn the framework to deal with location services.	Using iOS Software Development Kit (SDK[8]), XCode 4 Online OS X environment for development Macincloud[9] (for those who did not have a MAC to be able to develop) OS X Virtualization to run over Windows OS.	(b)

Table 2: Instructional activities and corresponding activities and tool

[1].LRN (www.dotlrn.org); [2]Mindmister (http://www.mindmeister.com); [3]Milaulas (http://www.milaulas.com);
[4]Cacoo (https://cacoo.com/); [5]Bubble.us (https://bubble.us); [6]Slideshare (http://www.slideshare.net);
[7]Educaplay (http://www.educaplay.com); [8]SDK (http://developer.apple.com/xcode/); [9]Macincloud (http://www.macincloud.com/)

3. MOOCs Environment and Learning Tool Support

Both MOOCs learning experiences had the LMS as a central access point although both MOOCs relied heavily on external tools and software. The LMS at Galileo University is an extension of the .LRN LMS [9]. New requirements have arisen to support a MOOC experience. One of the initial challenges was to have the correct hardware resources and the computational tuning to scale when usage peaks.

New and customized templates were required for the proposed structure of the MOOCs. This included the look and feel, content organization and user interfaces. Each MOOC had an entry page where the course outline was presented. Information about enrolment numbers and students' country of origin were also available on the same page. For promotional activities, each of the MOOCs had a Facebook page which contained information about the course and enrolment. Students were also able to log in from the Facebook page. Figure 1 shows an exemplar of the homepage of 'Introduction to E-learning' MOOC.

Figure 1. Homepage of the 'Introduction to E-Learning' MOOC

As mentioned previously, the xMOOC learning approach was designed with a limited number of tools per learning activity for both the cloud-based tools and standalone software. The development of the two MOOCs using various cloud-based and standalone tools are described as follows.

As a Mac computer and the OS X operating system is deemed to be expensive especially in developing countries, two alternative solutions were considered for the 'iPhone Development' MOOC. The first option was to enable a larger audience to access MOOC with an agreement with the service Macincloud, an online version of the OS X. This enabled users to fully use a real OS X installation over a browser in the cloud. This approach had some performance issues because of the network connectivity and high performance penalties of the cloud infrastructure provider running the virtual OS X instances. The second option was to run a virtual machine with OS X that was capable of running in Windows. Instructions on how to do this were provided to the students. Students with no background on virtual machines may find this option a challenge. For the 'Introduction to E-learning' MOOC, the cloud-based tools selected were not integrated in the .LRN LMS and the interfaces were not adapted, as such, the tools require their own login management.

The online forums tool called OSQA (www.osqa.net) was selected as a collaboration tool and this was based on reported experiences on computer supported collaborative learning [8] and the successful use of the tool at Udacity. This tool had proven technical scalability and was capable of administering to a large group. There was also a seamless integration between LMS and OSQA with the OSQA having the same look and feel as the LMS. Students were mostly unaware that different systems were used and the forums were presented natively in the LMS. Another vital component of OSQA was that it had a default facility for the gamification approach.

For assessment purposes, a rubric was created to support peer-assessment. Once the students have submitted their own assignments, the rubric tool will perform a random selection of one or more peers' assignment to start the process of a blind peer-assessment. After the assessment marking, students can access the peer assessment results. It is expected that the peer-assessment process will reinforce learning. The tutor can use a mean peer grading of the assignment and also moderate accordingly.

4. MOOC Experiences and Discussion

The planning of the MOOCs involved a promotion and enrolment phase of some 6 weeks. Following this, a week was set aside for orientation and familiarization with the tools. Basic demographics information about the students was also collected during this time. For those enrolled in the 'Introduction to e-Learning' course, more detailed information was collected. During the course, students accessed the MOOC content, interacted with their peers and tutors using collaborative forums and completed learning activities and assignments using different tools. Students also carried out peer assessment. Students who had successfully completed the MOOCs were asked to provide an evaluation of the MOOCs experience especially in the areas of MOOC usability, motivational and learning aspects and comments in general. In terms of the two MOOCs offered at Galileo University, the descriptive statistics for this are provide in Table 3. Some selected aspects and preliminary findings will be discussed in the remainder of this paper.

As shown in Table 3, as a first impression, the mean of final grades of students who had completed the courses was satisfactorily high (88% and 81% respectively). On the contrary, the dropout rates were also very high. The high dropout rates are consistent to those reported in the literature. There were more male students than female students, in particular the 'iPhone Development' MOOC had more male students enrolled in the course. However, it was not unexpected to have more male students in the 'iPhone Development' course.

The tutors commented that the students had completed all learning activities, accomplished the instructional objectives, and acquired the knowledge and skills covered in the MOOC. The students also provided the following positive comments, *'the course content was great, the teacher's explanations very clear. This course demands a lot of free time but definitely worth it'*, '*I really enjoyed the learning experience, I think the content, activities and methodology used were appropriate'*. Despite this, there were also some negative comments such as '[I] *would have liked more feedback about my activities'* and *'The course should be more organized'*. *'The use of the forum was confusing, there were many posts and was difficult to follow'* and *'Feedback was not directly from the teacher'*. With the last comment, students may not be familiar with peer-assessment and did not see the value of receiving feedback from their peers. There were also comments in general such as *'I loved the course because I learned to use new tools'* and *'I liked that they provide a variety of resources, not just PDF'*.

By narrowing down to learning content aspects and tools support, the following analysis is provided. Following the xMOOC approach, both MOOCs relied heavily on videos for content acquisition. A student commented on the experience that – *'for me it was very practical to learn from video tutorials'* and another student stated that *'I really liked that the videos were not so extensive'*. On the negative side, *'I believe that the theoretical explanation on videos should be more interactive or add animations to be a bit more attractive'* and *'in some videos the audio quality was not very good'*.

	(a) Introduction to e-Learning	**(b) iPhone Development**
Registered participants	1680	5365
Participants completed pre/post-questionnaire	690/143	-/74
Age	M=39 (σ=11)	N/A
Gender	Female: 739 (43.99%) Male: 941 (56.01)%	Female: 621 (11.57%) Male: 4744 (88.42%)
Country	Guatemala (76.60 %) Spain (5.11 %) U.S (3.63 %) Honduras (3.09 %) Mexico (2.20 %) Other (9.04 %).	Guatemala (72.04%) Mexico (6.13%) Spain (5.44%) U.S (4.62%) Argentina (1.73%) Other (10.17%)
Students Participation: a) Did not start the course b) With at least one login c) Delivered the first task d) That finished and pass degree of the course	 728 (43.33%) 952 (56.66%) 363 (21.60%) 143 (8.50%)	 2383 (44.42%) 2982 (55.58%) 356 (6.63%) 185 (3.44%)
Final grades for pass degree students (over 100)	M=88.61 (σ=8.36)	M=81 (σ=18.74)
Forum activities	773 questions/3511 answers	564 questions/2401 answers
	273 people active in forums	183 people active in forums
Peer-assessment	5 learning activities for peer-assessment	6 assignments for peer-assessment
Video resources	46 Videos	97 Videos

Table 3. MOOCs implementation

The MOOC courses placed an emphasis on 'learning-by-doing' tasks by hands-on activities with real tools and cloud services to prepare their skills and knowledge for real life scenarios. For the 'Introduction to e-Learning', videos were used to provide an overview of the cloud-based tools that were new to students. A student commented that *'the video-tutorials are very helpful to learn how to use the tools'* while another indicated that *'the videos are very monotonous, [it] needed more written documentation'*.

As for the 'iPhone Development' MOOC, the videos were primarily technical in nature (see Figure 2). A student provided the following feedback regarding the videos, *'the videos were difficult to see, I would liked to use youtube and that were a downloadable version of the video.'* With peer-assessment for the 'iPhone Development' MOOC, a student found *'the evaluation of the activities was very subjective, depended on the commitment of the student [to be] assessed'*.

The purpose of cloud-based tools in the 'Introduction to e-Learning' was for the learning activities to align with the instructional objectives. This included conceptual demonstration, structured knowledge representation and completion of assignments. The additional benefit for students included how to learn to use a set of free tools that could be applied for their own online courses. The learning activities grades for the activities were: 1) M= 83.63, σ =15.89; 2) M= 97.25, σ= 9.56; 3) M= 88.79, σ =15.57; 4) M= 81.99, σ =18.27; 5) M= 92.62, σ =17.03. This demonstrated that students were not only able to use the tools, but they were also capable of meeting the instructional objectives. Some students clearly agreed with the selection of tools based on the following comments, *'I liked it because they are easy to use and free apps'* and *'The tools used are very interactive, easy to learn and use'* but had some concerns such as *'Not all tools are free, and many includes a lot of ads'*. With the questions about cloud-based tools, in a 5 point Likert scale from totally disagree to totally agree, the students indicated that with the MOOCs *'It was fun to doing the learning activities'* with the results being M=4.37 σ =0.99, and for the statement on *'I liked the idea of doing these learning activities to represent knowledge acquisition'* resulting in a M=4.67 σ =0.74.

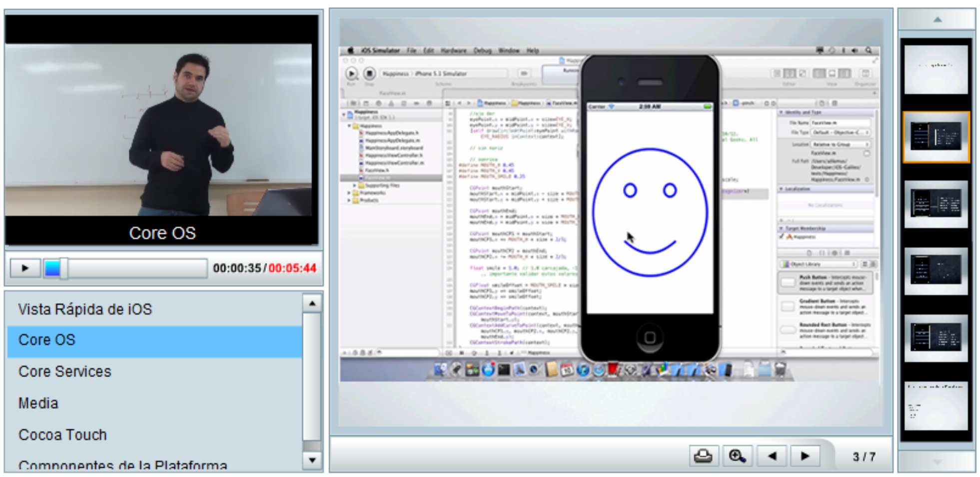

Figure 2. A MOOC class video of 'iPhone development'

As for the gamification experience with massive collaborative forums, the accumulation of badges gave a sense of competence, encouraging inputs; fostering interaction, and creating knowledge through social collaboration. For the 'Introduction to e-Learning' MOOC, the top 10 most active students had an average participation of M=24.7 for new questions and M=109.3 for answers, with a total of 31.95% for the overall questions and 31.13% for answers. For the 'iPhone Development' MOOC, the top 10 students had an average of M=9.9 for asking new questions, an average of M=52.8 for providing answers, making a total of 17.55% for questions and 21.99% for answers.

From the above, there seemed to be a high level of motivation although the number of questions and answers from the 'iPhone Development' students were notably fewer that the 'Introduction to e-Learning' group of students. The participation in the 'iPhone Development' MOOC was lower than in the 'Introduction to e-Learning' MOOC; however it is worth noting that the interaction in in 'iPhone Development' was more active.

After reviewing and analyzing the collaboration messages for the 'iPhone Development' MOOC, it was clear that the highly technical topics required more interactions to get the help and support required for students. As the level of attrition that occurred in the course was very high, the students who were left were usually motivated and were keen to do well in the course. This positive attitude provided the students with a sense of ‘community of practice’ who appreciated and committed to work with one another.

There were also problems with learning in the MOOC, in particular where comments about the same items were repeated and discussed over many times. This is especially problematic where a student commented that, *‘the use of the forum was confusing, there were many posts and was difficult to follow’*. This demonstrated a low level of individual capability to interact effectively in these massive forums. This is also an area of research focus on remix and filtering of feedback. Following interviews with some students, it was clear that students were overwhelmed with a large amount of postings, comments and questions. Moderating a large number of entries may also prove to be quite difficult for the tutors.

Focusing on the assessment aspects, there was a reasonable level of participation (M= 2.82 for ‘Introduction to e-Learning’ and M=2.96 for ‘iPhone Development’) on the number of times student performed peer assessments per assignment. An example of positive motivation related to peer assessment can be reported by a student who completed 17 peer-assessments for one assignment (for ‘iPhone Development). It was also interesting to note that 49.65% of the completed ‘Introduction to e-Learning’ MOOC students reported that they already had some type of formal peer assessment experience. Using a 5 point Likert scale, from totally disagree to totally agree, the response for “For the peer assessment, did you find the system easy to use?” returned $M=3.97$ $\sigma=1.06$ for the statement. Some of the positive comments from participants about their peer assessment included, *‘It is gratifying, also helps learn’* and *‘It is very rewarding because it allows itself to assess the performance of a peer’*. On the negative side, participants emphasized that *‘I am not convinced at all, is okay a review with a score by peers but the real score must come from the tutor’*, and *‘The rubric is subjective, too few criteria for real objectivity’*.

5. Summary and Future Work

The MOOCs experiences presented in this work demonstrated two successful courses with a high enrolment rate, and also a high drop-out rate. We have identified that students were initially interested in the learning opportunity as the two innovative thematic courses for the region were also available online at no cost. While the free nature of the courses attracted a big number of enrolled students, however a majority of these students showed a lack of commitment.

The two MOOCs also identified areas for improvement especially with peer assessment processes and better management of online collaboration for dealing with scalability of large groups. Higher retention in MOOCs is another evolving research question. The cloud-based tools have shown great scalability in particular with the new and innovative features. However, interoperability, orchestration and analytics of the tools remain another research area for this educational setting.

Final Remark

The experiences highlighted above motivated Galileo University to create an institutional initiative called ‘Telescope’ (http://telescopio.galileo.edu) with the aim of sharing knowledge in the Spanish speaking region and to reach out to a largely unreached populations across several countries. As part of the corporate social responsibility, it is the aim of Galileo University to increase participation in science, technology, engineering and mathematics (STEM) by delivering additional MOOCs in the areas of physics, mathematics, software development and e-education. The Telescope initiative is expected to deliver around 10 MOOCs in 2013.

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An Integrated Framework for the Grading of Freeform Responses

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Abstract

Massive open online classrooms (MOOCs) have the potential to educate millions of people around the world. Initial MOOC courses were in science and engineering disciplines, where the problems involve constrained choices and can easily be graded automatically. MOOCs must still find ways to deal with essays and short answers, which are required for classes in humanities and the social sciences, and are useful to a variety of other disciplines. Three of the general techniques for evaluating freeform content are self assessment, peer assessment, and AI assessment. We describe how these approaches are implemented in the edX platform, and we present an approach which integrates scoring and feedback from the three techniques in order to maximize accuracy and minimize student and instructor effort. This combined approach has the potential to offer greater accuracy and better feedback with less overhead than any technique in isolation. We present a preliminary implementation of the integrated approach, as built into the edX platform, as well as results from pilot experiments with self-assessment and peer grading.

I. Introduction

Massive open online classrooms have the potential to give hundreds of millions of people around the world access to the same high-quality education available to residential students at elite institutions while both improving residential education and providing tools that help us understand how students learn.

First generation MOOCs offered a very limited set of assessment types. For instance, the original Stanford AI course[1] was limited to numeric, true/false, and multiple choice answers. This limitation placed substantial constraints on the pedagogy that could be used. Second generation MOOCs began introducing richer assessment tools. For example, 6.002x, the first edX course[2], provided rich tools for automatic grading of complex problems, such as circuit schematics and symbolic equations, while courses like 6.00x and CS188x had rich autograders for computer code. These tools allow for a wide range of design problems and open-ended questions to be offered, but are still primarily limited to STEM disciplines.

As MOOCs move to offer courses in humanities and liberal arts, a range of new assessment techniques are being developed. Many of the more innovative involve substantial changes in course delivery. In this paper, we focus on techniques which lend themselves to assessment of conventional residential open-ended problems. Sections II, III, IV, V describe the isolated techniques, best practices, and how those are embodied in the edX platform. Section VI lays out a general formulation for the problem of integrating those techniques. Section VII describes a simple implementation of an integration, as embodied in the edX platform.

II. Self-Assessment

In self-assessment, a student is first asked to answer a question, after which they are shown a rubric and asked to assess their own answer. Self-assessment works very well in situations where a problem has a clear rubric, and where students have the requisite knowledge to grade their own work.

Students may have an incentive to rate themselves too highly, but self assessment can work well if combined with additional mechanisms to discourage this[3].

We piloted pure self-assessment in an edX solid-state chemistry course in the context of learning sequences. Since the goal of problems in a learning sequences is active learning and self-monitoring mastery (as opposed to grading), students had no incentive to cheat (and were not discouraged from doing so). A TA manually graded 106 of the student submissions. 71 of the self-assessed scores were identical to the TA score. The results are shown in Fig. 1. Since the question was optional, not all students answered. As a result, there may have been substantial sample bias. Of some interest in constructing the error model for the student grader is that students very rarely grade low (and then by a very small margin).

After students finished the self-assessment step, students were given the option to enter a hint that might help their peers with the question. We have not yet analyzed this data.

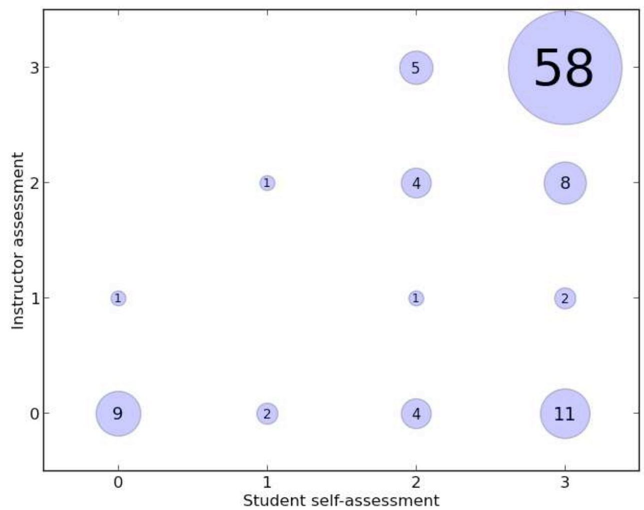

Figure 1. Accuracy for students self-assessing.

III. Peer Assessment

In peer assessment, assignments are graded by other students who have completed the same assignment. In the edX implementation, a student first answers a question, and is then shown a set of calibration responses that were previously instructor graded and asked to grade them along defined rubric dimensions. Once he reaches an acceptable level of accuracy, he is asked to grade the responses of other students and offer feedback. Non-expert raters have been found to rival the accuracy of expert raters under the right conditions[4].

Peer assessment has been used in a variety of MOOC courses, with varying degrees of success. Klemmer [5] found that peer grading can be an extremely effective learning tool. A high percentage of students indicated that they learned more from peer-assessing the work of others than from self-assessing their own work. There was found to be a .78 Pearson correlation between self-assessed scores and peer scores. Although no data was provided on the correlation between peer-assessed scores and instructor scores, the correlation between self-assessed scores and instructor scores was found to be .91, indicating that self-assessment was an accurate scoring mechanism.

IV. AI Grading

AI grading uses machine learning algorithms trained on instructor-scored student essays (typically, the first hundred essays submitted by MOOC students) to try to replicate instructor scoring across new essays. Once trained, AI assessment scores submissions immediately, and requires no additional human resources or input. Optionally, an instructor can rescore essays that the algorithm is not confident about (which can iteratively improve the model).

The ideas behind the algorithm used for AI assessment within edX is based on earlier work conducted during the Hewlett Foundation AES competition [6] by the VikP & jman team, where natural language processing (NLP) and machine learning techniques were used to automatically score essays.

In the Hewlett Foundation dataset, when trained with 10 fold cross validation on all available essays, it provided accuracy comparable to instructor grading. When trained on 100 essays only, accuracy falls off as expected, but is still close to instructor scoring. We tested this grading algorithm for short answers in a solid state chemistry course. Results from Hewlett, and preliminary results from chemistry, can be seen in Fig. 2.

The AI grading system does have shortcomings. It cannot reliably grade answers which do not to fit into the training examples. In some cases, it may be gameable by sufficiently clever students. It cannot give the same level of qualitative feedback as human graders. The first implementation contained feedback on spelling, grammar, and topicality. In response to student requests for more substantive feedback, rubrics have been incorporated into the AI assessment, and students can now receive feedback along an instructor-defined rubric.

The AI grading system is designed to be embedded in other platforms, and is available under an open source license. In addition, edX provides a hosted API solution.

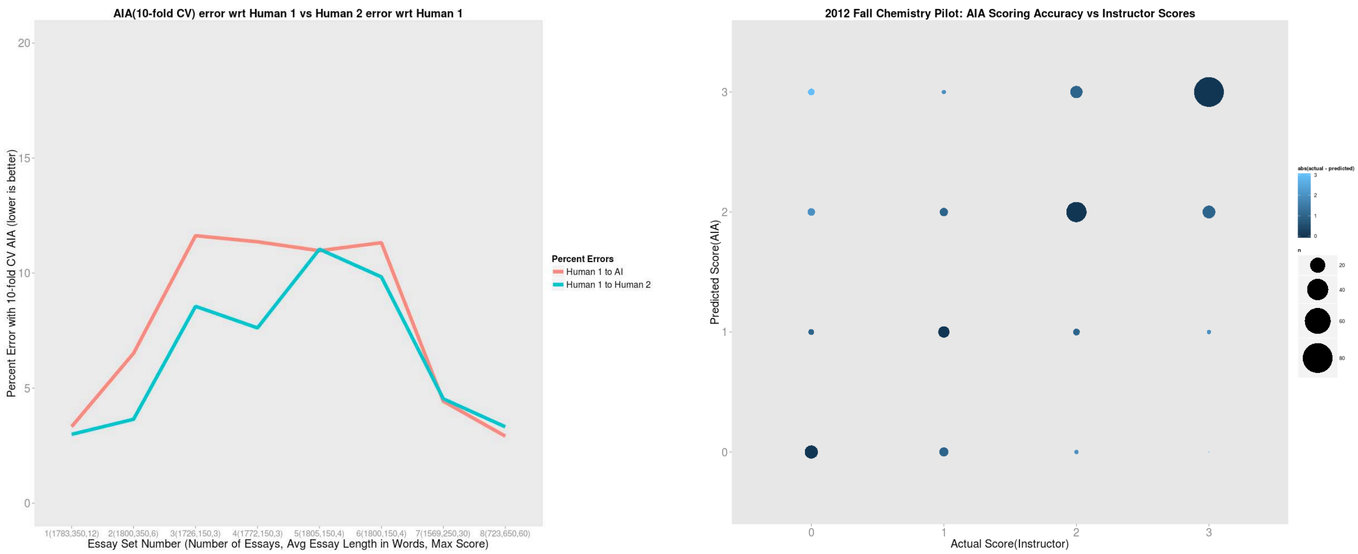

Figure 2. This plot on the left shows how well the AI grader matches a human grader on the Hewlett dataset, relative to how well two human graders match. The plot on the right compares the grades assigned by the AI grader relative to those assigned by a human instructor in the pilot chemistry course. The problems were graded by a single instructor, so we do not have numbers for inter-instructor agreement.

Question: Ion-Exchange Strengthening (3pt)
You wish to strengthen a glass by ion exchange. The initial composition of the glass is 90% silicon dioxide and 10% sodium oxide. Name a suitable salt bath composition with which to successfully strengthen the glass, and another one that would be unsuccessful in strengthening the glass. Explain the reasoning for your choices.

Rubric:

- Glasses fail under tension. In order to strengthen a glass, we need to create a surface compressive stress that resists an applied tensile stress.
- In order to create the surface compressive stress, we must use a salt with a larger cation that can exchange with the sodium ion in the surface layer of the glass. Potassium chloride is a possible candidate.
- Ion exchanging with a salt whose cation is smaller than sodium, such as lithium, will not create the needed compressive stresses at the surface.

Figure 3. A sample open-ended problem with rubric.

V. Rubrics

Each problem has a rubric associated with it. A goal of the rubric is to provide a mapping from possible student answers to scores for those answers. Another goal is to identify latent traits that are required in a good answer and expose them directly to the student. A third goal is to assist in identifying and classifying student misconceptions and levels of understanding of different concepts.

For simplicity, in the edX platform, rubrics are structured among a set of instructor defined dimensions. For example, for the problem shown in Fig. 3, the rubric has three dimensions. In the current system, the rubrics are statically defined. This is in contrast to the dynamic rubrics found in the original Coursesharing system[7], as well as the hash tags in Caeser[8].

VI. Problem Formulation

A student submits an answer a. In an ideal case, that answer would be matched to several positions in a rubric, one for each rubric dimension s. We have a set of assessment types. Each assessor g has a cost c associated with running it, and a cost u associated with preparing it for use. In most cases, the cost c is highest for instructor assessment, lowest for machine

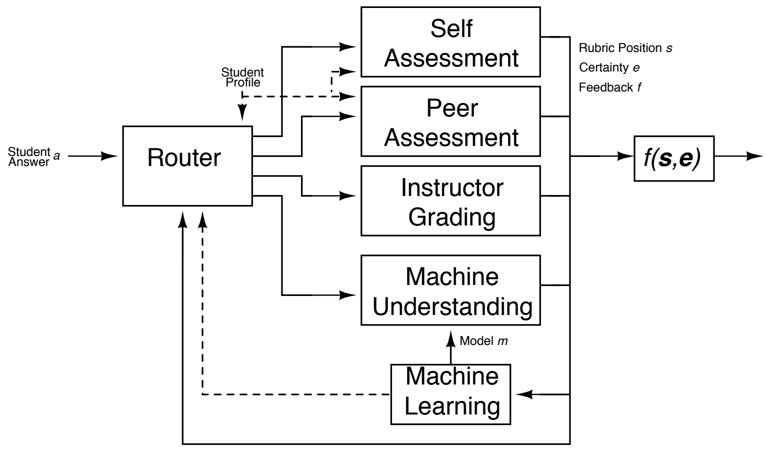

Figure 4. General formulation of routing problem.

grading, and somewhere in between for peer assessment (depending on the specific peer) and self assessment. In some cases the cost may be positive (e.g. if peer assessment is part of the teaching process). The i is currently 100 for AI assessment (training data) and 20 for peer assessment (student calibration problems).

Each assessor may output the student score $\hat{s}$ on each rubric dimension, an estimate of its certainty e (this may be estimated RMS error or a more complex error model), as well as qualitative feedback to the student. For each assessor, we may have an accuracy model $M_g(a)$ that estimates how likely it is to be able to generate an accurate answer.

We have several metrics we would like to optimize. First, we would like to minimize overall cost and the startup cost:

$$c = \sum_i c_i$$

$$u = \sum_i u_i$$

Second, we would like to minimize errors in grading:

$$|s - \hat{s}|$$

Finally, in a traditional explore/exploit trade off, we would like to build out better accuracy models of graders M_g, as well as to collect data to build better models for the AI assessment algorithm. This should lead to traditional models for judging self-assessment, such as spot checking.

VII. Implementation

Our first implementation is based on a stepwise linear flow. It allows the instructor to define explicit work flows for how the grading is handled, with an arbitrary number of steps (practically, 5 is a reasonable maximum). For instance, an instructor could define the following work flow:

- Student self-assesses. If the self-assessment matches an instructor specified minimum and maximum score threshold (ie the student rates themselves a 2/2 or less, but above a 0/2), the student moves on to the next step.
- AI grading assesses. If the AI score matches an instructor specified minimum and maximum score threshold, the student moves on.
- Peer assessment. That score is returned, as this is the final step.

Although the steps above are specific, any type of assessment can be inserted at any step, and any thresholds between the steps can be implemented. A student is shown scores and feedback for all completed steps.

This combined approach allows instructors to use problems in a way that works for the particular domain and particular assessment goals of the problem. For example, an instructor may be interested in a flow where a student first self-assesses, and is then peer assessed, and then self assesses again in light of the feedback from peer review. An instructor interested in minimizing resource usage may only allow a student to be peer assessed after they feel that their answer is correct (ie self assess it correct). This allows us to quickly explore different variants.

In order to implement these flows, an instructor must define a rubric and a prompt. They then must commit to grading at least 20 student submissions if peer assessment is one of the steps (for student calibration), and 100 student submissions if AI assessment is one of the steps (for ML training).

VIII. Next Steps

The edX integrated grading system provides a flexible framework for building out grading flows. In the future, flows may be tailored to a particular student via machine learning algorithms. Another potential area for improvement is in facilitating discussions between peer graders and the student who originally wrote the work. We have a mechanism for offering feedback on feedback currently that spans all assessment types, but it is preliminary. Ways to characterize students by the quality of their peer assessment or self-assessment are also potentially promising, as are annotation systems for providing feedback. We will continuously work on improving the system in general as we gather more data on how it is working in practice, and where the most pressing needs lie.

More radically, we'd like to experiment with non-traditional ways to assess students. Essays are commonly used for teaching students how to communicate, in part, due to limitations imposed by the physical classroom. Machine learning could potentially evaluate the quality of small group discussions, which may be both more pedagogically effective, and simpler technologically. In addition, we would like to allow students to upload videos and other non-traditional assessments (the system is currently limited to text and images).

IX. Conclusion

We presented a formulation for the design of an integrated system that can assess student essays and constructed responses. The system combines self assessment, peer assessment, and AI assessment in novel, flexible, fashions. We have preliminary data about how well the system works, but as adoption increases we will have more data about the system and its learning benefits.

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Massive Open Online Courses: a New Window on Education

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Abstract

Massive open online courses (MOOCs) offer a new window for observing student learning behavior. Time-stamped logs show when students clicked on which page of the textbook, skipped over or reviewed a section of the lecture video, asked or answered a question in the discussion forum, opened or answered a homework problem, etc. – information that is nearly impossible to obtain in a traditional on-campus course. We present an overview of such learning activities for the 108,000 participants behaved in 6.002x - Circuits and Electronics, the first course in MITx (now edX), a course whose structure mirrors a traditional on-campus course: lecture + recitation+ 2 exams. We concentrate on the7% of participants who obtained certificates because they accounted for 60% of the total time spent by all participants, and continued their activity through the entire course allowing week by week comparisons. We examine how the successful students (i.e. those receiving certificates) allocated their time amongst the various course components and study what fraction of each they accessed. This work lays the foundation for future studies of how resource use and learning habits influences learning in MOOCs.

1. Introduction

Forget the hype about MOOCs. Don't worry about the 100,000 registrants who never attempted significant homework (they had a median time in course ~ 20 minutes anyway [Seaton et. al. submitted to CACM]), or whether MOOCs reach out significantly to the disadvantaged. And most important, don't worry about whether MOOCs are a threat to colleges and their faculty – realize that they offer us a tremendous window into what we're doing as teachers, a window onto essentially all student learning activity in a course whose organization is that of an on-campus course using traditional lecture-recitation format. This paper will demonstrate that MOOCs represent a break-through way to study students' learning activity in a *traditional college course format.*

This is tremendously valuable because it has been so difficult to study much of the learning activity in an on-campus course. Do your students read their textbook? If so do they read it before class as some teachers recommend? Which resources available to on-campus students do they actually use: their textbook, the library, other students, the various tutor rooms? Admit it, we don't know, except for some self-reported surveys.

Our data consist of the 100GB of logged student interaction data from the inaugural MITx (now edX) course, 6.002x *Circuits and Electronics*, in Spring 2012: data at least two orders of magnitude larger than analyzed in previous studies of online learning [21,10]. We restrict the study to successful students – those who earned certificates. We examine the use of different course components (e.g. lecture videos, homework, discussion forum, e-text, etc.) in terms of user time allocation and the total fraction accessed. Our results emphasize the richness of data available from a MOOC like 6.002x.

2. 6.002x, Procedures, and Data Analysis

With some modification for online delivery, the 14 weeklong units of 6.002x largely mirror a traditional on-campus course in both format and timing. The prescribed course sequence (the left navigation bar in Fig 1) comprises lecture sequences consisting of lecture videos (annotated powerpoints and actual MIT lectures) with embedded lecture questions, tutorial videos (recitation substitute), weekly homework (3-4 multi-part problems), and weekly lab assignments (interactive circuit toolbox). Overall grades were determined by homework 15%, labs 15%, a midterm 30%, and a final 40%. Supplementary materials (top navigation bar in Fig. 1) include a course textbook (navigable page images), a TA- and student-editable wiki, and moderated student discussions. For further exploration of course structure and available resources, readers may visit the archived course (https://6002x.mitx.mit.edu/).

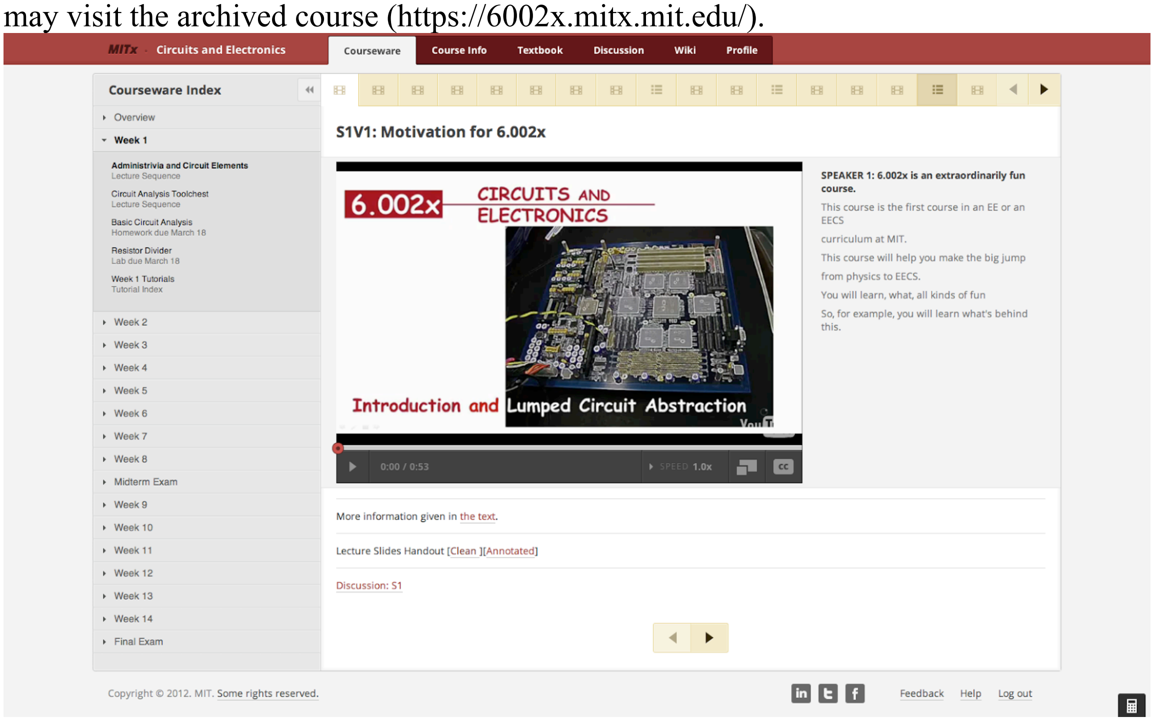

Fig. 1: Screenshot of typical student view in 6.002x. All course components are accessed from this interface. The left sidebar navigates to weekly modules containing lecture

sequences (videos and questions), homework, lab, and tutorials, while the header navigation provides access to supplementary materials: digital textbook, discussion forums, and wiki. The main frame represents the first lecture sequence; beige boxes below the header indicate lecture videos and questions.

3. Estimation of time spent on different resources

Time estimation for each participant relies on measuring the durations between a student's initial interaction with a resource and the time when they navigate away. We accumulate durations through analysis of each participant's time-series accounting for each separate course component (Homework, Book, Discussion Forums, etc.). We have evidence that those durations less than 3 seconds represent students navigating to desired resources, hence, we don't count these intervals as a legitimate student access. In addition, we add no time for durations over 1 hour, assuming that the user has disengaged from their computer much before that duration. Using alternate values of the high cutoff (20 min to 1 hr) can change overall times by 10-20%, but does not significantly alter relationships regarding time allocation among course components or total time spent by different participants.

An important point is that time accumulated is associated with the current resource. For example, if a student references the book while working on the homework, this duration is accumulated with book time. Only direct interactions with the homework are logged with homework resources. There are clearly alternatives to this approach, e.g. considering all time between opening and answering a problem as problem-solving time [21].

4. Results

4.1 Frequency of accesses

Fig. 3 shows the number of active certificate earners per day for, where large peaks occur on Sunday deadlines for homework and labs. There is a downward trend in the weeks between the midterm and the final exam (shaded regions). No homework or labs were assigned in the last two weeks before the final exam, though the weekly peaks persist suggesting that this periodicity indicates the students were otherwise occupied during workdays. We plot activity in events per active student per day for assessment-based course components and for learning-based components in Fig. 2B and 2C.

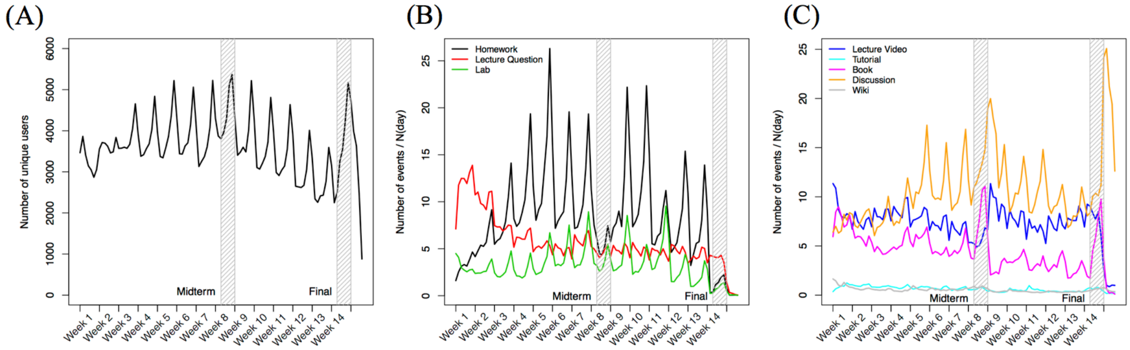

Fig. 2: From left to right, number of unique certificate earners N(day) active per day, their average number of accesses each day for assessment-based (middle) and learning-based course components (right panel) each day. Plot (A) highlights the periodicity and trends of overall activity. Plot (B) shows assessment-based (Homework, Lab, Lecture questions) accesses per active student. Learning-based activities (Lecture videos, Textbook, Discussion, Tutorial, Wiki) are shown in plot (C)

The activity per user is very periodic for Homework and Labs – the "for credit" assessments, as well as for the highly used discussion forum, which is the most frequently consulted resource for students doing homework. This indicates that students do homework near end of the week. On the other hand, lecture videos, lecture questions, and the textbook are not used more frequently over the weekends.

Several trends emerge over the length of the course. Lecture question events decay early as homework activity increases. Textbook use peaks during exams, and there is a noticeable drop in textbook activity after the midterm [18], offset by a rise in lecture videos. The use of discussion forums to help with homework lags the increase of homework activity early in the course.

4.2 Time on Tasks

Time represents a reasonable interpretation of a cost function for students, making it important to study how they allocate time among available course components [15, 19]. Figure 3 shows that the most time is spent on lecture videos. The biggest change over the first seven weeks is the apparent transfer of time from the lecture questions to the homework (see Fig. 3). Spending so much time on lecture questions (that didn't count toward the grade) is hard to rationalize from a performance goal orientation (5); however on mastery-oriented grounds, it is possible that students saw completion of the longer homework problem assignments as sufficient evidence of understanding the lecture content. However, it is possible that students decided in advance how much time to spend, and had time for lecture questions only when the homework load was light.

The prominence of time spent in the discussion forums is noteworthy as these were neither part of the course sequence, nor did they count for credit. Presumably students spent time in the discussion forums because of their utility in helping with the homework, and also possibly because of their social value. The small spike in textbook time at the midterm, a larger peak in the number of accesses (see Fig. 3), and the decrease in textbook use after the midterm are typical of textbook use when online resources are blended with traditional on-campus courses [18]. Further studies comparing blended and online textbook use may also prove fruitful [3,17].

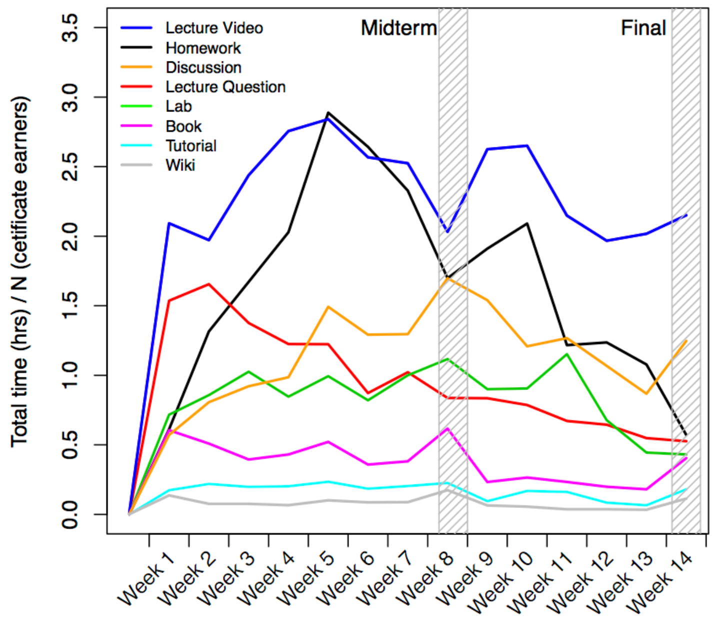

Fig. 3: Time on tasks.

Certificate earners average time spent in hours per week on each course component. Midterm and final exam weeks are shaded.

4.3 Percentage Use of Course Components

The extent to which students use various course components is, along with student time allocation, an important metric for instructors deciding how to improve their courses and for researchers studying the influence of course structure on student activity and learning. For each course component, Fig. 4 shows the percentage of certificate earners that accessed at least the percentage of that resource shown on the x-axis. Homework and labs (each 15% of overall grade) display high fractional usage. These curves drop sharply around 80%, probably reflective of the course policy of dropping the two assignments with the lowest grades. The low proportionate usage of textbook and tutorials is similar to the distribution observed for supplementary (that is, not explicitly included in the course sequence) e-texts in large introductory blended physics courses [16], though the 6.002x textbook was assigned in the course syllabus. The course authors were disappointed with the low usage of tutorial videos and suspected that placing tutorials after the homework and laboratory (for which they were meant to help) in the course sequence was partly responsible. (The wiki and discussion forums had no defined number of resources and so are excluded here.)

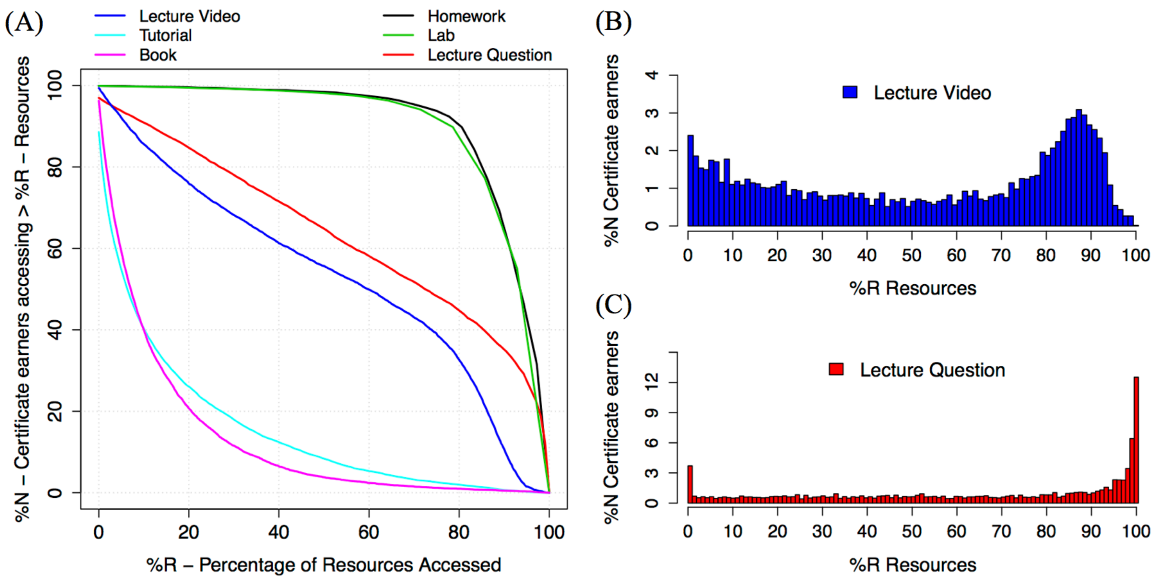

Fig. 5: Fractional Usage of Resources. (A) The percentage of certificate earners that accessed greater than %R of that type of course resource. The density of users is the negative slope of the usage curve. (B) The bimodal distribution for videos accessed (as percentage) (C) Distribution for the lecture questions.

To better understand the middle curves, representing lecture videos and lecture problems, it helps to recall that the negative slope of the fractional research usage curve is the density of students accessing that fraction of that course component (see Fig. 3b and 3c). Interestingly, the distribution for the lecture videos is distinctly bimodal: one quarter of the certificate earners accessed less than 20%, and 40% accessed over 75%. This bimodality merits further study into learning preferences: are some students learning from other resources exclusively, or are participants who already have good knowledge of the content prior to this course simply not watching the lecture videos? The distribution of lecture problem use is flat between 0% and 80%, and then rises sharply, indicating that 40% of the students access over 80% of them. Although the time spent on lecture problems dropped significantly the first third of the term (See Fig. 3), 75% of the students accessed over 1/3 of the lecture problems, suggesting a trend of looking quickly at these questions rather than ignoring them.

The results shown so far have many hallmarks of effects seen in on-campus studies of how course structure affects resource use [18], and performance outcomes [4,11] in introductory (college) courses. Future MOOCs might extend the large amount of research on education generally, and take advantage of some of its insights (e.g. that frequent exams drive resource usage and maximize learning outcomes [11]).

5. Conclusions

This paper illustrates several methods for analyzing and interpreting the logged data for students who obtain certificates in a MOOC: distribution of their time amongst resources, their activity overall and for each resource, and their fractional use of those resources. Certificate earners invested the plurality of their time in lecture videos, although one quarter of them watched less than 20%. This suggests the need for a follow-up investigation of the correlations between resource use and learning. Finally, we highlight the significant popularity of the discussion forums in spite of their being neither required nor included in the navigation sequence. If this social learning component played a significant role in the success of 6.002x, a totally asynchronous alternative may be less appealing, at least for a complex topic like circuits and electronics.

In concluding, we re-emphasize our main point: MOOCs are ideal vehicles for education research; partly because they lack the constraints of culture, economics, and classroom design present in on-land education, but mostly because they allow research based on detailed insight into all learning activities of the students. To the extent that the advantage of time-stamped logs of essentially all student behavior and the associated learning throughout the entirety of a course is dissipated by the increased variability of students in MOOCs, the large sample sizes will enable the study of specific student cohorts (e.g. based on demographics [9], effort, and learning habits.). Combining time-on-task observations with measures of learning will allow measurements of the amount learned per unit time spent on a given course component; possibly extending previous studies of online learning [7,15]. We are optimistic that the data from MOOCs can lead to a process of cyclic improvement based on research development, experimentation, and measurement of learning outcomes, allowing substantial improvement of educational content and delivery.

6. Acknowledgements

This work was supported, but is not endorsed, by NSF grant DUE-1044294. We thank MITx for data access, and J. deBoer and other members of the Teaching and Learning Laboratory and RELATE groups at MIT for helpful suggestions and comments. This paper is a shorter and simplified version of a longer paper submitted to Communications of the American Computing Machinery.

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MOOC'ing in Belgium

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Abstract

This paper aims to review the MOOC movement in relation to higher education in Belgium. Firstly, I will briefly outline the amount and nature of Belgian universities, drawing from official statistics and eight years of personal experience as both a student and employee. After this, the paper will focus on the university of Leuven, which is the highest ranked Belgian university. A review of some general characteristics of this institution hopes to highlight its agreement with the values of open courseware, or MOOC's specifically. However, Belgian activity in the development of MOOC's has been rather modest at the time of writing. Conditions to pursue higher education are already ideal, and this paper will demonstrate little apparent need to engage in a massive, open, online education. In other words, the lack of obstacles is in this case the biggest impediment to full engagement. Yet the growing desire to innovate which originates in individual lecturers will point out that there is no lack of enthusiasm. Next to this, a case study will serve to show that for some courses, a MOOC would be the natural evolution in the provision of higher education with a larger scope. The conclusion of this paper hopes to be an invitation to academics abroad to unite in an endeavor of international scale, providing high quality dissemination of knowledge in a critical, collaborative platform which surpasses the current potential of the isolated MOOC.

Introduction

Belgium is officially a trilingual country, each group of speakers home to geographically distinct areas. Flanders is home to the Flemish population, next to which there is a French-speaking community of an almost equal size, and a German minority. The Flemish and French parts each have their separate institutions for higher education and own legislative power over them. The German speakers usually integrate into either of these communities.

Both the Flemish and French community have seven recognized universities. Two of the French and four of the Flemish institutions are currently ranked in the top 200 worldwide [10]. These institutions offer degrees ranging from bachelor's up to doctoral and postdoctoral studies, following the Bologna agreement which has standardized education in Europe. Bachelor degrees are offered in the language relevant to geographical location, some subsequent studies are also offered in English to appeal to students from abroad. Most degrees at higher education institutions in Belgium are readily accessible to anyone who has successfully graduated from secondary school. Some degrees such as medicine may require additional entrance exams.

The fees for studying at Belgian universities are set by the government, and usually amount to about 600 Euros per year in Flanders, and slightly more in the French community.
Leuven is a city to the east of Brussels, the capital of Belgium, and is home to Belgium's most highly ranked university [10]. With approximately 30,000 residents living in the centre, it is a relatively small city boasting a long history as 'place to be' for cloth trade in the Middle Ages. Founded in 1425, the university located here will be the focal point for this paper.

The KU Leuven

The university of Leuven, or KU Leuven, is in fact a member institution of the *KU Leuven Association*, which is a form of networked organization for universities and university colleges usually on national level. This particular association accounts for 90.000 students, which is 43% of the total Flemish student population, spread across 23 Belgian cities [8]. Next to accredited courses from Bachelor degrees to postdoctoral programs, the KU Leuven organizes and is involved in the organization of many lecture series, short and long training courses, postgraduate workshops, lifelong learning initiatives,... With an academic staff of approximately 7,000 people the KU Leuven caters education for approximately 40,000 students; 45.3% of these are enrolled in one of the 55 Bachelor programs, 30.2% in any of the 132 initial Master's [8].
In terms of ranking, the KU Leuven is the most highly ranked Belgian university, and in the top 100 worldwide [10, 12]. As a European university, it is among the top 15 [12].

Good times

Despite its size, higher education in Belgium holds up well in international comparison. In terms of technology, it can be said that all institutions in the country actively engage with technology in teaching and research. However, a MOOC has not been high on the Belgian agenda. The KU Leuven's characteristics do promise a lively engagement in the MOOC movement, as indicated below, but the level of active involvement has been low thus far. As this paragraph will show, Belgium does not encounter many of the named impediments in bringing education to all, which other institutions have to face. In fact, conditions are ideal.
Firstly, the development of MOOC's at specific institutions may be hindered by contextual challenges [2,5], which are not applicable to the Belgian situation. The basic structural provisions for e-learning in terms of electricity, hardware, internet access, safe and accessible classrooms,... have been met. The university offers high-speed internet to all students, on campus and in the university residences, and special arrangements for students in privately-owned housing are easily available. Government statistics show 77% of Belgian families had access to the internet in 2011 anyway [4].
Student mobility figures show a lively interest in international study. More than 15% of the KU Leuven students have come from abroad, 3,750 of which come from within the European Economic Area (EEA), and an almost equal amount from outside, particularly from China, India and the US [8]. Admission of foreign students is determined by the individual institution, and will involve checks of the students' prior qualifications and linguistic ability. Active participation in the Erasmus program, for example, means about 800 students came to Leuven in the 2011-2012 academic year through this initiative enabling study abroad for one

year. Also, the KU Leuven had 615 outgoing students in that year [8]. As the capital of Europe, Brussels is a point of international focus, appealing to a wide variety of cultures and nationalities.
Linguistic and cultural diversity of the Belgians certainly provides an additional strength. Next to being a trilingual country, the pervasion of the English language through media and online is very strong. Most Belgians will have some to excellent knowledge of English, as it is also compulsory in secondary schools. For the academic world, it is certainly the case to speak of English as a *lingua franca* of research, and increasingly, of teaching.
The mission statement of the KU Leuven also resonates well with the idea of MOOCS in its aspiration to be 'a place for open discussion' which encourages 'personal initiative and critical reflection' and to 'actively participate in public and culture debate and in the advancement of a knowledge-based society' [8].
In its international strengths, Belgium could easily provide a thriving MOOC with global appeal. Many existing MOOC's specifically attract students abroad, next to an older generation in lifelong learning activities. Belgium's ageing population would be another motivation and reason to 'MOOC *en masse*' and connect with peers limitlessly.
There are plenty of reasons why Belgium can be fertile soil for MOOC's and yet the actual involvement is low to this day. The following paragraph hopes to touch the surface of an explanation for this unexpected situation, by reviewing some of the reasons often heard in the development of MOOC's, and how this would apply to the Belgian context.

Too much of a good thing

The MOOC movement can be characterized by an altruist endeavor to bring education to all. Obstacles to this could be firstly the geographical difficulty of reaching a location which provides high quality education. This could be the case in the United States, which covers a vast territory often forcing choices to move away from home and family to pursue higher education, or for students in African or Asian countries where travel simply might be difficult. Belgium is a small country, and the roads and public transport infrastructures are relatively efficient and affordable. In Leuven, people can easily get around on foot and by bicycle, and students or staff of the university can take the bus around the city for free.
Another often-heard obstacle to pursue higher education are the rising tuition fees, to which a MOOC of course aims to provide a solution. A student of Arts and Humanities, for example, would however pay a total fee of €600 (on average) to enroll at a Belgian university for one year, versus £7,000 in the UK for a similar degree, and a more varied range of fees in the US, some ranging over $30,000. Though these amounts do not include accommodation and other necessities, but the KU Leuven also offers various partial funding solutions for both the fees as well as reduced-fee student housing. The cost of a room in the city centre will be approximately €250 in non-subsidized university residences, and up to €600 in the private housing market.
The basic conditions to pursue higher education in Belgium are pretty ideal in comparison to other countries. The typical motivations 'to MOOC' have therefore little relevance in many European countries as compared to the US for example, since the socio-economic context is entirely different [3].

However, these are benefits from the students' point of view. The advantage of MOOC engagement from the institutional perspective are not often stated so explicitly. Through enabling a MOOC, academics could impact a much larger student population and if run successfully, sustain a community of crowdsourced knowledge, as well engage in a critical collaboration with peers. The following paragraph will indicate through a practical illustration why the development of a MOOC could prove to be a useful enterprise even though the needs are not immediately apparent.

Case study: Online Publishing

The Master's Degree of Cultural Studies has been offered at the KU Leuven since 2007. Since then enrolment has increased to over 200 students in last academic year.

Approximately half this number have taken the course 'Online Publishing' last year, which has grown from an option to a core 6-credit subject. Not all student participants are pursuing the MA of Cultural Studies; the course can still be chosen as an option in related degrees, the MA Information Management being the highest subscriber (20% of the total number last academic year).

The course aims to familiarize students with state-of-the-art online publishing and digital culture, in a practical manner but at the same time seen through the lenses of relevant theory, interpreting cultural issues and analyzing social impact. The lessons start in a traditional lecture mode in the first three weeks, followed by a series of workshops in function of one of the exam assignments (the building of a website in small groups). The lectures offer the core theoretical framework delivered through the discussion of concrete digital artifacts and phenomena of online publishing. This takes place in a traditional lecture hall, with a large projection screen at the front. Most students (still) take notes on paper, but increasingly many of them bring in their personal laptops and other mobile devices. For the last two years of the course, these lectures were video recorded in-class and published through *Videolab*, a streaming media service powered by the KU Leuven association. The workshops following the initial lecture weeks are in place to meet the practical aims of the course and focus on a hands-on approach. Computer rooms are booked outside typical lesson hours to allow students the opportunity to work together, while the lecturers circulate periodically during these drop-in sessions to help and answer questions. The students do a lot of self-study with help of the documentation on the *Blackboard* virtual learning environment, which includes how-to videos, useful links, and 'tips and tricks'. To merge theory and practice, there is also a mid-term literature class where students read four core texts of digital culture prior to the lesson moment, during which they then apply the theoretical foundation to the concrete subjects they chose for their websites. *Qikpad* is used during this lesson, which is a free online collaboration tool: all discussion groups take notes of their analysis and summarize instantly through a text document made and shared online. The resulting summary is saved and published to the *Blackboard* course later on. Any students who were not able to attend this class are asked to comment on their group's analysis via the course forum.

Throughout the course, there is a focus on current digital artifacts to highlight theory and analysis, and ongoing news in online media and digital culture. The final mark of the students is made up of three deliverables: the website which they have made in small groups, followed by a presentation to pitch this product, and a paper which they have written individually on a subject of their choice (but still relating to the overall theme of the course). The formal minimum requirements of these assignments are laid out beforehand, though the students enjoy a relatively high degree of freedom in choosing the contents and methods of their concrete targets. For example, the website they make by the end of the course needs to be technically perfect in compliance with one of the requirements, but the degree of complexity is their own choosing. They can choose any platform to use based on the level of confidence, commitment and capabilities in their group. *Wordpress* and *Drupal* are the two platforms suggested and supported in the course.

The popularity of the degree, as well the course itself, is growing and therefore student numbers are rising in accordance with the general increase of the student population. The qualitative assessment (the production of a website as group work, followed by a presentation, and an individual paper assignment) and weekly face-to-face moments of this course are proving hard to maintain for this growing number of students. Examination could take place more efficiently with instruments such as a multiple choice test, but this is felt to be unsuitable to the nature and level of this course.

To provide this course as a MOOC would not only be the solution to the growing maintenance issue, it would also be its natural development. Firstly, the theme of the course - online publishing and digital culture - is of course aligned with the MOOC domain. Next to this, the course values team work as well as independent performance. In terms of assessment, two things will already change for next year's generation of students taking the course: they will have the choice between writing a paper or a blog to complete the individual assignment, and more peer evaluation will be put in place to assess the performance of the website building in groups, and each other's individual writing task. Both of these measures would be well-suited for a MOOC. Also, self-study and independent work is heavily encouraged during this course, which agrees with user surveys indicating that over half of open courseware consumers are self-learners [9]. Independence of the MOOC student is certainly important, but this is a common expectation for higher education students anyway. The lectures given during the course are already being recorded and published online, but in a closed learning environment. All digital artifacts, online publishing phenomena and provided documentation such as PowerPoint's and how-to videos could be easily distributed over a MOOC platform as well. The workshop mode of the course could be a virtual moment, asking students to collaborate over the web in the construction of a website, as well as delivering support fully online via chat sessions, a forum and/or email. Currently, the students are already asked to form their own groups for the website assignment via the forum; often collaborating with peers they have never met before, bringing different backgrounds and skill sets to the table, but uniting in the same topic. Many tend to arrange meetings via email and social media such as *Facebook*.

It seems the contents and method of this course would be well-suited for a MOOC. Its characteristics agree fully with the nature of open, online courseware. The 'massive' feature poses some concern, however, and points towards the biggest need of MOOC development. To enable its success, a MOOC needs a group of academics to collaborate. The next paragraph will indicate why this would benefit the knowledge disseminated in a MOOC, as well as the individual academic involved in its organization. Suffice to say here that a growing student number goes hand in hand with a larger team of staff maintaining the course. It is not advisable for one lecturer to engage in the organization of 40,000 students (Strauss 2013). Firstly, this creates a truly great workload for a single person which is unmanageable considering the many other responsibilities and requirements imposed on the modern academic. Secondly, cooperation allows a quality control on content, method and management which will improve a MOOC even beyond the traditional course. This cooperation can of course be done inter-faculty or inter-university members, but a team of international academics is a much more interesting intellectual endeavor. A MOOC student population is rarely limited to its national borders, but neither should the leading team enabling the course be. Consortiums on European scale or beyond would be a meaningful solution, for example [3], though a global reach would be even more exciting for all parties involved. It will improve accessibility and participation in the course, and boost growth of the professional community for students and lecturers alike.

Aiming for better

The conditions to actively engage in the MOOC movement are ideal in Belgium. However, the need has thus far not been a great one, particularly because the often-heard rationale for MOOC's focuses on the country-specific students' perspective. Distance, cost and flexibility are easily overcome in Belgium. Yet the aims and nature of the KU Leuven, and particularly the course of Online Publishing discussed above, resonates well with MOOC's, validating a current trend as its natural development. Moreover, this change in course delivery could mean greater opportunities for academics and the enhancement of knowledge. A large knowledge market is brought forward and sourced simultaneously, by opening up quality courses to a larger, more varied population across the world.

It is certainly true that Belgium is geographically not the most complex destination to reach, but the opportunities are never situated in a single location anyway. The greatest possibility of bringing quality education lies in international academic collaboration This fits both contemporary society and modern learning. The 21st century student is a connected one; able to consult literature and connect with peers across the world in a matter of seconds. This is essentially what a MOOC aims to do, bringing a global community of learners together in one virtual whole, but it is still just one confined unit of learning. Opportunity for true educational progress today lies in combination: MOOC's organized by different institutions or networks, bringing these patches together in the quilt of one coherent degree. Bringing education to all is a noble pursuit to help those seeking out knowledge, but formal degree certificates are prerequisites for employment in today's world. To help students advance professionally, MOOC's would firstly require correct and widely applied accreditation, and recognition of differently obtained credits in one body. MOOC'ing would then evolve to a global university, available at the fingertips. However, some MOOC's which are available as accredited courses today, are less cost-effective for students because of formal identity checks by independent companies and related costs. Perhaps the answer is not to adapt MOOC's to our existing accreditation, but to grow a greater cultural recognition of MOOC certificates and degrees on resumes worldwide.

Not only courses and credits should be assembled in a coherent whole. People, academic and non-academic, need to operate together to achieve maximum impact. Firstly, this ensures a critical view on each other's content delivered to students, and method to do so. Open Educational Resources (OER) are crucial elements here, and initiatives such as the Open Course Library, linking courses to available open courseware, can enhance MOOC content and participation even more [9]. This project aims to address one of the current difficulties of open resources: there are so many it is difficult for lecturers to find the appropriate resource, and students alike, sifting through endless material which is irrelevant or inadequate in level of quality.

The KU Leuven is actively concerned with open courseware (OCW); in July 2010, the institution adopted a policy for open content leading to the publication of an open series of KU Leuven courses, using the existing website platform of the university. All course content is available online, complete with study guides and exercises. On the basis of this policy, the leading lecturer of the course 'Online Publishing', taken as case study of this paper, is now a core member in the OCW Consortium (opencourseware.eu).

Collaboration of lecturers could help to bring in pieces of the puzzle together in one MOOC, organizing and structuring the experience for the student in the same effort. Of course, the platforms offering open courses are filters of quality as well. Many impose contractual obligations to keep content correct and updated.

In bringing minds together, the viewpoints of different institutions and cultures would merge in one enhanced unit of knowledge. The MOOC could then truly provide a platform for meeting and cooperating with other growing professionals, both as students and staff. A study of the MIT Open CourseWare Project showed that academics did feel the positive effects of this process, resulting in better content and better connections [9]. Also, they felt it improved their intellectual recognition because of the wider audience; similarly the KU Leuven could increase its global outreach by taking a course beyond the Belgian border - virtually. As time goes by and more institutions are positively disrupted by MOOC's, the impact of this decision on 'getting out there' will unfortunately decrease.

Conclusion

Bringing education to all will be most meaningful when the endeavor is shared by academics on an international level. The days of sole pioneers and missionaries are no longer relevant nor feasible; the wisdom of crowds is what matters in today's interconnected world. This paper hoped to show that the main motivations in the development of MOOC's form no immediate needs for higher education in Belgium. At the same time however, situational requirements to actively engage in this movement are ideal. The nature of the KU Leuven and one of its courses at the Faculty of Arts and Humanities given as example in this paper shows how a MOOC would even be a natural evolution. Yet there is an even bigger potential for the advancement of education to pursue here. MOOC'ing is only the first step. Powerful and empowering education can be realized through the combination of isolated MOOC's in coherent degrees or boosted cultural recognition of individual certificates. This and an increased quality of education can be established through a joint effort of individual academics, supported by a consortium of institutions. This remains the greatest challenge, to entice academic partners beyond the border to join in a challenging, innovative process within a functional framework which has international appeal. The concept of a global university emerges at the virtual horizon, transcending local limitations and local needs (or lack thereof), answering to a higher pursuit of intellect fit for the modern day. A united cooperation of academics around the world could launch this, though it requires reaching out beyond the borders of the known, both geographically and intellectually. In today's society, that attitude should exist almost by definition anyway.

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MOOCs and Foucault's Heterotopia: On Community and Self-Efficacy

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Abstract

Massive open online courses (MOOCs) present challenges for individual student self-efficacy and relational communities of learners. Foucault's concept of the "heterotopia" is examined as a lens of the no-place place by which barriers between the individual and the community are called into question as seemingly disparate concepts. Contextually mitigated with Freire's "problem-posing" and Siemens' "connectivism," it is further argued that self-efficacy and relational community are congruous and dependent entities which provide insight to the future of digital architecture.

1. Introduction

The proliferation of recent online phenomena called massive open online courses, or colloquially referred to by their acronym, MOOCs, is significant both to higher education and the value systems of society. The "open" nature of MOOCs, which at the writing of this paper are primarily cost-free and available to anyone with a computer and an internet connection, has societal implications for those who would otherwise be negatively affected by affordability, access, and quality of education.

The problem with attempting to take an academic view of MOOCs is the general lack of scholarly literature, presumably from their recent development, prominence, and ongoing evolution. The lack of literature also means a paucity of empirical evidence to examine the quantitative aspects of MOOCs. These limitations suggest the best path of analysis is through a lens that helps bring together seemingly disparate information. Our proposal is to examine some of the lecture notes of Michel Foucault's "Des Espace Autres" ("Of Other Spaces") which elaborate on what he calls "heterotopias" [9]. Though originally written for a talk given in March 1967, Foucault's thinking bears especial relevance to today's MOOCs: "We are in the epoch of simultaneity: we are in the epoch of juxtaposition, the epoch of near and far, of the side-by-side, of the dispersed" [9, p. 22]. As asynchronous, widely-accessible learning platforms, MOOCs close educational boundaries once firmly affixed in brick-and-mortar schools; this "dispersed" status begs questions of space, or in Foucault's language, "the space of emplacement" [9, p. 22]. Haider and Sundin (2010) make a similar connection when they argue, "The Web is constituted of an incalculable and constantly changing amount of non-linear interlinked digital objects which together create an enormous and continuously growing digital space or rather spaces" (p. 6). A careful distinction is necessary between Foucault's coinage of "heterotopia;" he is not elaborating on a dire, anti-utopia (or dystopia), but rather a "placeless place" [9, p. 24]. Foucault uses the example of a mirror to illustrate what he means by heterotopia: the mirror presents an image that is "there" but only as an image; a mirror image is both in a place and in no-place.

The conceptual challenges of MOOCs mark out space to be explored with Foucault's heterotopias, or more specifically, the sites "that have the curious property of being in relation with all the other sites, but in such a way as to suspect, neutralize, or invert the set of relations that they happen to designate, mirror, or reflect" [9, p. 24]. MOOCs tread on the utopia of education, the promise of knowledge, power, and social mobility vis-à-vis traditional or even online platforms, thereby marking out space that undermines the monetary value of education all the while elevating the value of disseminating the potentiality of knowledge for those who otherwise may not be participants.

We posit the underlying dichotomy within the structure of a MOOC is best framed as that of a community of a learners and individuals' self-efficacy. These are by no means opposite categories, but rather internal tensions present in courses where individuals form a community of (sometimes) thousands of students. Foucault's thesis of heterotopias helps us contextualize MOOCs' marked out space, the tensions of community and self-efficacy within that space, and how the future of disseminated learning changes digital architecture.

2. MOOCs, self-efficacy, and a community of learners: a brief overview of literature

Very specific characterizations are necessary to understand how MOOCs are both situated deeply within educational contexts and, simultaneously, challenging what "self-efficacy" and "a community of learners" mean. Student self-efficacy is rooted in psychological motivations for completing or dropping out of a MOOC; likewise being part of a community of learners is rooted psychologically in terms of connectivity to others, responsibility to others, and mutual relationships to other students. These themes are explored in a general sense to provide a context with which to analyze how MOOCs as heterotopias provide insight to learning changes.

2.1. Student self-efficacy and MOOCs

In psychological-educational terms, self-efficacy, or an individual's confidence in his or her ability to effectively complete a specific task [1], is important to establish a common language of motivation. Self-efficacy influences an individual's behavior in ways like performance in tasks and the amount of effort applied to the tasks [1]. Self-efficacy can be an important mitigating factor in education because it entails effort, participation, engagement, and output. More specifically, a measurement of self-efficacy can be applied to distance learning, and more particularly to MOOCs. The dearth of scholarly literature on MOOCs suggests that comparable models of educational research into self-efficacy may help align theory of participation with empirical results of low completion, or the rise of what are called "lurkers" (those who may interact with MOOC materials, but do not leave digital artifacts behind to evidence their participation). What motivates individuals to participate in, and more importantly successfully complete, MOOCs? With the exceptionally high number of dropouts and few active participants in these courses, the question of what is affecting the participants' behavior becomes pivotal.

The application of extant research on distance and online learning self-efficacy is helpful to a conceptual understanding of MOOCs because there is an extensive body of research showing how self-efficacy relates to a student's behavior, performance, and achievement in online learning environments. Zhang, Duan, and Wu (2001) conducted a study that examined participants' self-efficacy in relation to their achievement in a distance learning program at a university in China. This study concluded that students' distance learning self-efficacy significantly affected learning achievement in the distance learning environment. Another study conducted by Simmering, Posey, and Piccoli (2009) showed participants' computer self-efficacy was positively related to learning in an online course. This study also concluded that students' previous experience with using computers and the Internet related to increased computer self-efficacy [28]. Bates and Khasawneh (2007) showed previous experience with online learning increases students' self-efficacy in online learning environments. This study also showed that self-efficacy influenced students' outcome expectations in an online course.

Irizarry (2002) discusses the importance of self-efficacy in online learning environments. He explains that self-efficacy affects student achievement in online courses as well as the motivation levels of individuals in online courses [12]. Wang and Newlin (2002) concluded a student's perceived self-efficacy in an online course was significantly related to choosing to enroll in an online course as well as to the final exam score received. Lynch and Dembo (2004) concluded that participants' self-efficacy was positively related to the final grade received in an online course. Joo, Lim, and Kim (2013) also found self-efficacy predicted achievement for participants in an online university. However, Joo, Lim, and Kim (2012) concluded self-efficacy did not predict achievement but did affect the participants' learning flow. Similarly, Renninger, Lewis, Adams, and Ernst (2011) discuss the need for more research on self-efficacy as it relates to online learning as well as how this research could help design future online courses to take into account the participants' differences in self-efficacy. In most studies, self-efficacy has a significant impact on students' behavior and achievement in online courses.

Other research appraising self-efficacy and behavior in online courses shows self-efficacy affects individuals continuing with online education and that students' self-efficacy in online education can be increased through experience. Simmering et. al. (2009) and Bates et. al. (2007) established previous experience with computers and online learning environments increased students' self-efficacy. Similarly, Chu and Tsai (2009) report that the more time and experience adult learners have on the Internet, the more their self-efficacy increases. With a higher Internet self-efficacy, students will be better able to function and participate in online learning environments [5]. Furthermore, Chu and Chu (2010) concluded that having social support for adults in online courses can enhance Internet self-efficacy. This study also showed how important Internet self-efficacy is to keeping adult learners in online learning environments. This specifically highlights what Irizarry (2002) explains, "If a person believes that he or she can complete a task, the probability that he or she will engage and become resilience [sic] to any obstacles increases." Therefore, it is important to be able to raise students' self-efficacy to further enhance their participation in future online learning situations. Studies indicate self-efficacy is increased through experience, which will further allow individuals to successfully continue in online learning environments.

Self-efficacy, as a descriptor of student motivation, participation, and achievement, is important for a deeper understanding of MOOCs. In relation to distance and online courses, the concept of self-efficacy starkly points to an inverse in MOOC participation. At the very least, this sharp inverse allows us to ask some key questions. Does self-efficacy tell us something deeper about why MOOCs have such a characteristically high drop-out rate? Does it also say something psychologically compelling about why there are so many are lurkers in MOOCs? Would students' high self-efficacy possibly help increase the participation and completion of MOOCs?

2.2. A Community of Learners and MOOCs

In recent decades, higher education underwent a dynamic shift in purpose from one that is lecture and faculty-focused, to one that is much more student-centered (e.g., [2]). This shift ushered in a variety of new learning formats that supplement, complement and sometimes replace traditional face-to-face forms of learning including blended learning, fully online small classes, and MOOCs.

A sense of community is highly relevant to understanding these alternative learning platforms. "Community" refers to "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" [18, p. 9]. Of especial note here is that this definition does not indicate any physical or material commonalities among group members, but rather a sense of community is predicated on *processes* of interaction. Based on a review of extant literature on sense of community, Rovai (2002) argues that sense of community comprised four dimensions: spirit, trust, interaction, and common expectations (i.e., learning goals).

Sense of community is operationalized using a Classroom Community Scale [22] that assesses overall classroom community in addition to two subscales: connectedness and learning. Connectedness, in this case, represents "the feelings of the community of students regarding their connectedness, cohesion, spirit, trust, and interdependence" (p. 201). Learning represents community members' feelings "regarding interaction with each other as they pursue the construction of understanding and the degree to which members share values and beliefs concerning the extent to which their educational goals and expectations are being satisfied" (p. 201).

Rovai (2002) notes seven factors related to sense of community, specifically in online contexts: a) transactional distance, b) social presence, c) social equality, d) small group activities, e) group facilitation, f) teaching style, and g) community size. Transactional distance refers to the subjective psychological and communication space learners feel between themselves and others. Social presence refers to how present or absent an individual is in an online community. For instance, instructors of online courses who regularly contribute to discussions build social presence. Social equality highlights the importance of each student feeling "safe" to contribute in the online classroom. Threats to social equality and, therefore, a sense of community can occur when students take authoritative tones during online discussions. Small group activities help bolster a sense of community in online classrooms because they can break large groups into smaller ones (i.e., fewer than 10 students) in which groups complete a specific task in a set time period. Group facilitation refers to the instructor's ability to inspire learners to interact both around instrumental and relational issues. In terms of sense of community, instructor's teaching style and students' learning stage are directly linked. Optimal teaching is situational because instructors can adapt and accommodate the needs of all learners. Finally, community size influences sense of community. Students who feel that they are merely one in a very large class often do not feel a sense of community.

Strong sense of community has been associated with several outcomes including lower levels of student burnout [17] and fewer student-reported feelings of isolation [11]. As Tinto (1975) argued in regards to traditional face to face learning environments, feeling as if one "fits in" and has a myriad of opportunities for interacting with other students and faculty is critical to college success. In recent years, a sense of community in blended learning environments provides additional context. Blended learning can include any combination of face to face and online elements and has been praised for its flexibility [23]. Using a causal-comparative design, Rovai and Jordan's (2004) findings suggest that blended courses produce a stronger sense of community among students compared to either traditional or fully online courses.

For the most part, research on sense of community in educational contexts has been conducted within the confines of "traditional" learning environments. However, the increase in MOOCs challenges what we know about this construct because they allow for learners and instructors to interact outside of these traditional educational structures.

In line with notions of sense of community is connectivism or connectivist learning [8; 26]. Connectivism refers to learning as a collaborative—rather than top-down—activity in which individual learners become members of (online) networks and, through communication with others, co-construct knowledge and learning experiences. Siemens and Downes (2009) emphasize the importance of human agency and the necessity of active participation in connectivist learning. They point to four types of activity for successful learning: (a) *aggregating* information, (b) *remixing* and reflecting on resources and relating them to what people already know, (c) *repurposing*: learners creating something of one's own, and (d) *sharing* one's work and activities with others.

In their analysis of two MOOCs, Kop, Fournier, and Mak (2011) note, "many participants realized the importance of connections with other learners and of relationship building to advance learning. However, in a MOOC, they found these things extremely hard" (p. 87). These authors included the following quotation from a participant: "I still feel like I struggle to make collaborative relationships online and asynchronously. It is as much a need to improve my relationship-building skills and perfect my organization abilities with existing tools."

Though much of what is thought about a sense of community in a MOOC is theoretically extrapolated from earlier studies on traditional and online education, recent research suggests the sheer volume of students in MOOCs create serious hindrances toward forming relational connections necessary in a community. More specifically, Rovai's (2002) Classroom Community Scale has only been used in blended learning or "smaller" online learning environments, but not MOOCs. Could we realistically expect MOOC learners to highly endorse some of these items? For example, items such as "I feel that this course is like a family" or "I feel that students in this course care about each other" might be particularly far-fetched for a course of 1,000 students. Is it necessary, then, to reframe what "sense of community" means for the MOOC context?

3. Emplacement: Theoretical Views of Self-Efficacy and Community in MOOCs

Foucault's heterotopias serve as a useful lens to help us understand the tension between what is marked out in the digital space of MOOCs as well as the relationship between self-efficacy and community that is occurring inside the human-machine space of MOOCs. If we are to take seriously Foucault's assertion, "our epoch is one in which space takes for us the form of relations among sites," there is an interconnectivity that drives a structural foundation of action within "a system of opening and closing that both isolates [heterotopias] and makes them penetrable" [9, p.23; p.26]. Within the place/no-place opposition of the heterotopia is a "place" that allows for a highly-theoretical penetration of connectivity between self-efficacy and community. To align an educational construct with heterotopic emplacement of MOOCs, we turn to theories proposed by Paulo Freire and, more recently, George Siemens.

Freire proposed a view of education contrarian to the more traditional view whereby there is a sharing of information between teacher and student. Freire describes the traditional and oft current view of education as a "banking style" (as cited in [20]). In this model, the teacher is an all-knowing expert whose job it is to deposit information into a receptacle, the students. He explains that in this concept of education, knowledge "is a gift bestowed by those who consider themselves knowledgeable upon those whom they consider to know nothing" (as cited in [20] p. 189). This view of education takes away the ability of the students to contribute and share their ideas and categorizes the students as having nothing to contribute. This banking style places the teacher categorically above the students. This view of education requires the students to passively memorize information rather than take an active role in the learning process.

Freire describes his idea of education as "problem-posing" (as cited in [20]). Problem-posing education takes away the authority of the teacher and replaces it with a teacher who is "taught in dialogue with the students, who in turn while being taught also teach" (as cited in [20], p. 194). Freire's concept joins the teacher and students in a process where all involved grow and learn together through one another. This problem-posing model of education varies greatly from the "banking style" because it encourages egalitarian, active learning. Selim (2007) suggests that the rise of online education takes seriously Freire's critique. Perhaps an even more acute example of a contrarian model of "banking style" education is the MOOC because students take a leading role in the learning process. MOOCs are designed to allow the participants (students) in the course to direct the information that is being shared and elaborate on it; students engage in active learning because they direct the learning process. Like Freire's model, MOOCs go against the "banking style" of education. Students in MOOCs are not seen as ignorant receptacles to be filled, but rather as individuals who have information to share and contribute in the learning process.

The majority of MOOCs employ the theory of connectivism, which advocates learning between individuals [25]. This is the idea that in order to expand students' knowledge base, they must make connections with other individuals and share information [25]. Some of the principles of this theory are the diversity of opinions, the process of learning taking place by connecting specialized information, and connecting information between fields and concepts [25]. Connectivist concepts and principles are closely aligned with what takes place in MOOCs. As online courses that allow many individuals from around the world to share information with each other, MOOCs provide the means for participants to connect their specialized knowledge with other participants' knowledge.

The conceptual alignment of Freire's theory and the pragmatics of MOOCs are held together with connectivism. Connectivist theories allow for the correlative space to examine how both Freire and MOOCs go against traditional models of education. Traditional education does not provide means for individuals to share information between each other and connect each individual's field of knowledge. MOOCs, on the other hand, demonstrate how Freire's views education *should* work. According to Freire, education should be a connecting between individuals who share, learn, and teach in the process of learning; the pragmatic dynamics of MOOCs allow this very thing. The question, then, becomes with an understanding of how MOOCs actively encourage the learning process, how do self-efficacy and community contribute to learning in these courses?

The lack of scholarly literature treating MOOCs yields a particular challenge; to systematically apply self-efficacy theories we rely on literature from online courses. Though this is methodologically difficult because online courses differ from MOOCs, they also share a lot of similarities, especially in physical and digital delivery. Both MOOCs and online courses provide incentives to take the courses. The strongest similar incentive is the act of learning, which is extremely important in both types of courses. With online courses, the incentive, with successful completion of a curriculum, is a degree. MOOCs, on the other hand, do not qualify individuals for a degree, but some MOOC providers offer badges (certificates of completion) to show a student completed the course. A central difference is that with completion of a MOOC, a student receives the incentive forthrightly; in online courses, multiple different courses are needed to receive a degree. Both types of courses provide incentives for individuals to participate.

With online courses and MOOCs, the digital architecture and mechanisms of work are also similar. In each type of course, individuals must use a computing device (i.e. digital architecture) in order to access the course, assignments, and information. Individuals in each course are also encouraged to submit assignments, information, and one's knowledge to the course electronically (i.e. mechanisms of work). Skills in navigating the Internet are also needed for each course. Even though MOOCs and online courses may have differing guidelines in delivery and how they are conducted, both types require similar skills, digital architecture, and mechanics of work in order to participate and learn. Since each type of course requires certain skills in order to effectively participate and complete the course, the idea of self-efficacy for successful completion is similar in each course.

Self-efficacy is especially important to MOOCs because students have to be confident in their capabilities to navigate and succeed in the course as well as have confidence that the course will work for them [31]. Students' self-efficacy for success in a MOOC is directly related to performance because if a student does not believe they have the skills to participate then their performance will ultimately suffer. This aligns with the research discussed above where self-efficacy has shown to play a vital role in one's performance and outcome in online courses. Therefore, with self-efficacy having such an effect on performance how can this be raised in order to enhance participation in MOOCs and combat the high dropout rates of these courses? Perhaps the relationship with a sense of community is highlighted best here; if self-efficacy is encouraged and nurtured externally (either by an instructor or fellow students) in a MOOC, then the community benefits from active and engaged self-efficacious learners.

Further qualitative context is helpful to fill out the connection between performance, self-efficacy, and the relationship to community. In his blog, M. Crosslin (2010) discusses what caused him to drop out of a MOOC. He explained that he was unable to figure out how to work and navigate the MOOCs he attempted. Therefore, his self-efficacy in navigating these courses was low, causing him to drop out of the course. Crosslin (2010) compared his experience in a MOOC to feelings he similarly experienced in 500-person lecture halls in college. He stated that it was easy to feel as if one was disappearing into the masses. By feeling like one has disappeared into a course composed of hundreds or thousands of students, it can further lower a participant's self-efficacy if they cannot seem to find a way to make their voice heard in the community. It is helpful to question if personalized feedback is the panacea to enhancing self-efficacy and further participation in MOOCs, thereby enhancing communal activity. If students receive feedback and believe they are heard, will they more fully participate in the course?

Briefly returning to Freire's model of education to draw out meaningful analyses, more student effort is needed for success. Students are not expected to just sit, listen, and memorize information anymore; rather, students are expected to share, question, and make individual connections with the material. This is similar to participation in a MOOC. In order to learn in a

MOOC, students must continue to locate information through course navigation, share information with other students, and create digital artifacts by sharing their thoughts and knowledge with others. Students cannot be passive members of a MOOC or they will soon find themselves lost in the masses without a voice. Students have to enter a MOOC with a level of self-efficacy that gives them the confidence in their own voice as well as confidence to navigate a MOOC. Experience in MOOCs will help to enhance the self-efficacy in individuals with low self-efficacy and will possibly even take individuals whom already have a high level of self-efficacy and enhance it even more. Possibily one of the paradoxes of MOOCs are they are dichotomous because individuals will either remain lurkers or will engage their self-efficacy and more fully participate in the community of learners.

Foucault's concept of heterotopic emplacement helps bridge the gap between community and self-efficacy because the mutual dependence of each one reflects a (em)place(ment) that is both place and no-place. MOOC students who are self-efficacious contribute to learning in a community; the very act of commitment to participatory learning lends relational development within the community. Similarly, active renegotiation of knowledge, relational interplay between students and instructor, and a sense of trust all build community vis-à-vis self-efficacious individuals. The mirror of Foucault's heterotopia shares an uncanny relationship with this view of community/self-efficacy in MOOCs: "this place that I occupy at the moment when I look at myself in the glass at once absolutely real, connected with all the space that surrounds it, and absolutely unreal, since in order to be perceived it has to pass through this virtual point which is over there" [9, p. 24]. Something is lost in the emplacement of the no-place place – and found – in MOOC students who must overcome the obstacles to being self-efficacious learners and who, in turn, form relational communities of learners.

4. Conclusion: Digital Architecture of the (no)Place

Foucault worked well before the time of digital connectivity, widespread personal computing devices, and the challenges and opportunities presented by massive open online courses. Yet his work is conceptual enough to bear more than a passing resemblance to relational interconnectivity. His lexicon does not necessary reflect some sort of pre-knowledge of the coming digital revolution(s), but it does speak to the problems of space in terms of a dichotomous place / no-place of today's technology.

Foucault's heterotopias reflect well the redefinition of community in terms of self-efficacious individuals forming purposeful learning communities and those communities bolstering and encouraging self-efficacy in its individuals. The traditional divisional lines between individuals and communities are brought into focus through MOOCs. The no-place emplacement of MOOCs means that students who dedicate themselves to learning form communities and those communities sustain individuals. This also signals the challenge of the future of MOOCs: designers, instructors, and MOOC platform providers must find different spaces, new horizons of emplacement, and individual-community building potentialities to further the model of *truly* open education.

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The MIT LINC 2013 Conference

Parallel Presentations

Session #4
Overcoming Diverse Barriers with Technology-Enabled Education: Case Studies

- "Group Online Collaboration For Scholarly Articles Readability and Understandability: SOAR" presented by Bee Bee Chua (Australia)
- "Intercultural Communicative Competence Development In Teletandem Learning Context" presented by Sami B. Al Hasnawi (Iraq)
- "Education's Ability to Build Bridges in a Post Conflict Scenario" presented by Hazel Jones (Northern Ireland)
- "Conditions for a Sustainable Online Master at CERAP" presented by Serge Azidé Lorougnon (Ivory Coast)
- "Blended Learning in Complex Environments: Reaching Learners in the Field" presented by Barbara Moser-Mercer (Switzerland)
- "Conflict Resolution and Peace Building in J&K State: Need for an Integrated Educational Framework" presented by Dr. Renu Nanda (India)
- "Autonomous Empowerment through Pre-recorded Presentation Software: A Case Study from an EFL Setting at Kanda University of International Studies" presented by Lucius Von Joo (Japan)

Group Online Collaboration For Scholarly Articles Readability and Understandability: SOAR

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Abstract
Challenging scholarly articles are not easy to read and understand by learners. Our previous work shows an innovative learning framework –SOAR (Scholarly Article) validated on a group of learners without research experience on improving their comprehension skill on scholarly articles. In this paper, we present additional result after validating SOAR on novice learners who first time read scholarly articles. SOAR is based on a theory of Brown's et al, emphasizing the importance of collaborating and sharing educational knowledge, so that various scholarly articles can be understood faster and more easily by students, researchers and academics. It places heavy emphasis on research, its integration and incorporation within learning activities, and on allowing learners to build their research, analytical and critical review skills. It is based on the concept of scholarly articles as the key subject context integrated within courses as part of a test assessment or a tutorial-based activity in an e-learning environment, as an alternative approach for maintaining educational sustainability. In turn, the aim of this framework is to help learners understand scholarly articles by encouraging them to collaborate and discuss challenging issues online with other global learners and, through the appropriate use of a tool for collaboration, to generate inventive and innovative ideas.

1. INTRODUCTION

Educators, researchers and learners are the three largest consumers of scholarly articles. Educators use scholarly articles for teaching and research purposes; learners and researchers use them for learning and gaining knowledge. Different educators have different expectations from learners when using scholarly articles in their teaching. Some educators focus on writing and expect learners to write a summary after reading a scholarly article, thereby learning how to write a short version of a research paper and providing evidence for assessment of the learner's writing and analytical skills.

Other educators are more interested in evaluation, asking learners to critique scholarly articles to test learner's understandability. Other educators interested in enquiry expect learners to answer questions relating to scholarly articles to test their critical analysis and problem solving abilities. Yet others want learners to read scholarly articles to elicit and share ideas with other learners. Although none of these approaches is a "bad" technique, they all lack guidance for learners in how to tackle the difficult task of reading and understanding scholarly articles.

Comprehension is an essential skill that learners (readers) must possess. Unfortunately, it is especially difficult to develop and cultivate comprehension while carefully reviewing or studying somebody else's research especially for a learner who does not know the researcher work. In this paper, we introduce the Scholarly Articles (SOAR) readability and understandability framework. It is useful for students who are taking a research subject, or a subject with a research activity as a component. The utility of SOAR does not only reduce the reading time of scholarly articles, but helps readers overcome their comprehension difficulties, through online collaborations and oral presentations on scholarly articles. In addition, other soft skills – such as critical and analytical thinking, building and sharing of knowledge and research – can be improved when theory and practice are integrated.

The SOAR framework was validated from 2008 to 2012, via compulsory use in courses where students required an online system for learning support. Some results [1,2,3,4] showed that the framework contributed significantly to postgraduate students' learning: 1) Delivering a positive impact on the development of students' critical thinking, innovation, presentation and team collaboration skills through brainstorming on various problems drawn from the articles; 2) Inducing a decline in the assessment failure rate in which students summarised scholarly articles in subjects with an emphasis on integrating state-of-the-art understanding and state-of-the-practice understanding for undergraduate students; for an example the theory of teamwork applying in real world contexts. 3) Helping students understand how academic writing differs from contemporary writing, thereby helping them develop their own writing style; and 4) Letting students maximise their thinking space by guiding them to view problems from different perspectives and innovate creative solutions.

The testing and validation of the SOAR framework is further extended in this paper to include first-time undergraduate and research students with no prior experience in literature review, where the process can be of value in helping them read and comprehend more scholarly articles over a shorter period of time. The paper is structured as follows: 2) related work; 3) the distinction between concepts of learning and collaborative learning; 4) framework introduction; 5) the framework process;6) summarises the students' learning outcomes;7) students' feedbacks and the last section provides a reflection of the research and future directions.

2. LITERATURE REVIEW

Since the launch of open source software, many E-learning tools have been developed voluntarily through developer collaboration. Western countries are adopting E-learning faster than eastern countries, according to a European survey report [5]. Large European organisations and universities have progressively moved forward incorporating e-learning in education and training. Thus, huge investment costs in E-learning are expected. To stay competitive, many e-learning suppliers and designers internationally aim to produce high quality e-learning systems [6,7].

One of the challenges in designing e-learning systems faced by designers and developers is the lack of intuitive content and difficult to incorporate interactively. Many educators emphasise high content-based materials on e-learning systems [8,9,10,11], possibly reflecting a traditional perspective that teaching is based on learning concepts first then tackling the application of what is learned. Unfortunately, in reality, not all learners can solve problems even if they know the relevant concepts well [12]. This is potentially due to the lack of an integrating cognitive learning process to connect concepts and problem-solving [13].

For educators to be competitive at the technology cutting-edge, a research component is strongly encouraged to be integrated into any e-learning courses. Research drives innovation; consequently new technologies push to improve our lives through newly-created products, processes and services. In other words, learning is not an act, a process or an experience of gaining knowledge and skills; it should be a lifelong process of transforming information and experience into knowledge, skills, behaviours, and attitudes.

The goal in this paper is to seek a way to enhance learning to be as effective as possible to encourage learners to learn widely and deeply beyond a “concepts-only” level. An objective to support this goal is based on the constructive, guided learning SOAR framework.

3. CONCEPTS OF LEARNIN G AND COLLABORATIVE LEARNIN G

What is learning? Numerous philosophers [12,13,14,15] view learning as based on the following sequence:

1. To increase one’s knowledge;
2. To memorise and reproduce,
3. To apply,
4. To understand,
5. To see something in a different way,
6. To change one’s thinking.

Learning helps learners to develop cognitive skills such as reading, understanding, thinking, memorising and applying [12]. Collaborative learning is an extension to the concept of learning. Collaborative learning goes beyond the acquisition of knowledge by identifying the strength and weaknesses of a group; for example, while some people are good at understanding theory, others might be better at understanding the social aspect of a subject, and how to better communicate with a wider audience. One could consider different roles within a group, such as: leader, experts, and communicators, where people could play different roles in each discussion, to promote the dissemination of points of view [1,15].

4. FRAMEWORK

The framework aims at improving students’ research, collaborative and presentation skills. Importantly, the framework also aims at improving students’ critical thinking ability to assess scholarly articles and to draw innovative ideas of their own. The design of this framework (Figure 1) relied on the educational theory developed by Brown et al [15], which aims to foster a circle of educational knowledge building and sharing [16]. Figure 1 shows the SOAR framework of scholarly articles as a subject component and as an input. The framework creates an educator’s thinking space in which to decide whether to use scholarly articles as 1) a class activity, 2) a test assessment or 3) whether to integrate it and remix into a tutorial.

The SOAR framework shows both educators’ and students’ interest and the differences in their thinking space on scholarly articles. Students’ thinking space in particular is needed to develop their research skill, and analytical and learning (critical thinking) skills on different scholarly articles. Using the SOAR framework can strengthen students to develop their critical thinking, improve their presentation skill, and collaborate with other peers.

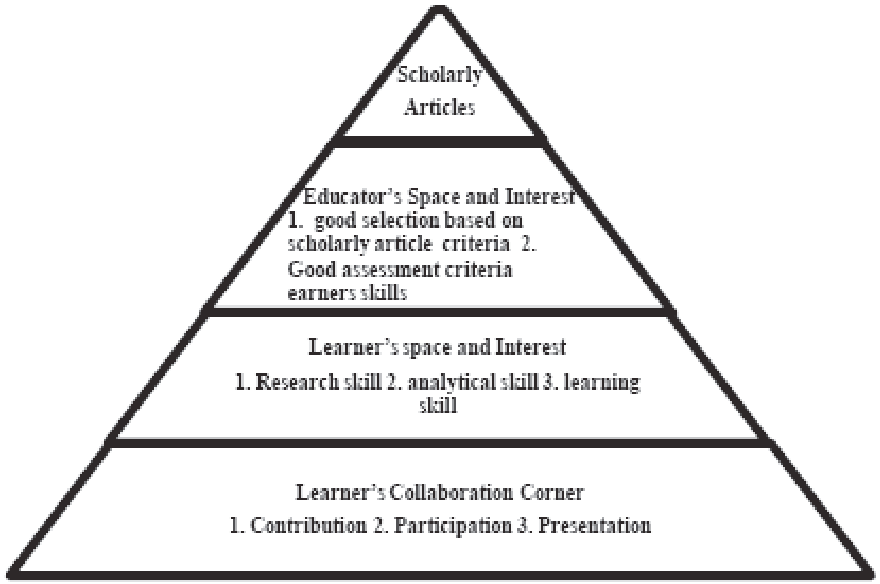


Figure 1 SOAR Framework

The SOAR framework's contributions include:

a) Helping students understand scholarly articles. The author of this paper is the subject coordinator of undergraduate and postgraduate subjects that introduce concepts of information systems strategy place a heavy emphasis on theories focusing on understanding the difference between the state-of-the-art and the-state-of-the-practice business strategy and change management. Many theories are developed based on researchers' expertise. Using SOAR students will gain a better understanding on how theories are presented and how they are relevant to the real world. They will also develop research skills by extensively working on these articles.
b) Improving students' analytical and critical thinking skills through understanding how academic writing differs from contemporary writing, and develop a skill in building their own writing style in their attempt to bridge a practical and theoretical understanding of what they are reading.
c) Motivating students to collaborate within and across teams and enhance teamwork by brainstorming on a set of problems drawn from the articles.
d) Lastly, the framework guides students into maximising their thinking space by helping them develop ideas that can help them look at problems from different perspectives and innovate creative solutions.

5. FRAMEWORK PROCESS

The framework was validated in three postgraduate classes in 2009, 2010, 2011 and two classes in 2012 of one postgraduate subject and one undergraduate subject. Each class was approximately 20–60 students and each collaborative group was comprised of 3–5 students depending on each semester enrolment intake. To validate this practice-based framework, two stakeholders were required, i.e. educators and learners, a subject input, scholarly articles and a tool to support learners' collaboration and participation. Without an appropriate e-learning system, managing scholarly articles for a large class size would be difficult, especially if critical discussions and online participation are required. It is essential to have a learning tool to test the framework.

The framework consists of the basic procedure and steps below which are not difficult to follow: an educator creates his or her thinking space to decide where to use scholarly articles when using an e-learning system. He or she asks whether it is for 1) a class activity, 2) a test assessment or 3) to integrate it and remix it into tutorials. Table 1 shows steps and dimensions of the soar framework.

Table 1. Steps and Dimensions of the SOAR Framework

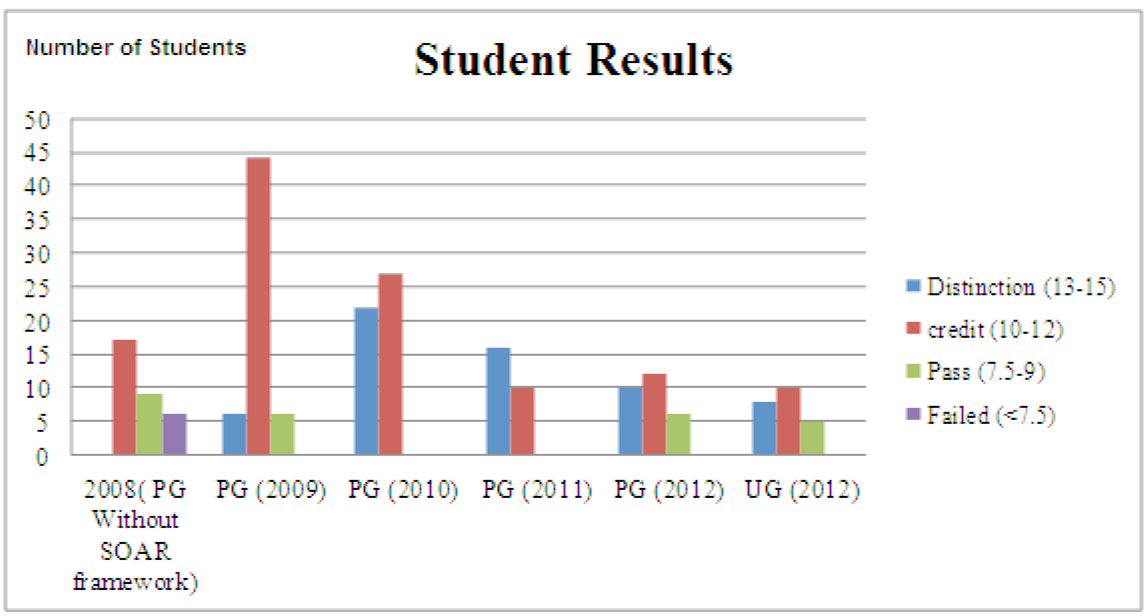
Step	Dimension
1. Educators create a subject folder for materials to be uploaded to an e-learning system	Educator's thinking space and interest: • Good selection based on scholarly article criteria • Assessment criteria to evaluate learners' skills
2. Every topic is attached with a document, *e.g.*, a scholarly article for learners to download and read and assessment criteria attached for completing the task	
3. A group discussion board is created for learners to discuss weekly papers	
4. Learners are assigned to read weekly scholarly articles	
5. Learners upload their questions which relate to the industry context with reference to the paper	Learners space and interest • Research skill • Analytical skill • Thinking skill
6. Learners can upload their questions to the discussion board	
7. Learners invite other learners on the same course to provide input and comments	Learners' collaboration corner: • Contribution • Participation • Presentation
8. Educators use their pedagogical skill and knowledge to review learners' research questions and other learners' comments as to whether they are valid or invalid. Educators can make comments to correct or clarify matters on the discussion board	
9. Learners are required to deliver a presentation online. In the presentation, learners must discuss the paper's topic and their questions relating to an industry case, and provide a summary or outline the statistics of other learners' comments on the questions asked on the discussion board	

6. LEARNIN G OUTCOMES

We assessed students learnability using the marking template of an assignment which formed the basis of a metric to benchmark student's performance before (2008) and after the SOAR framework was implemented in 2009, 2010, 2011 and 2012. In the marking criteria, a total mark of 15% is allocated to three sections which were divided into 5 marks for each section: 1) Knowledge of the material, including the relevancy of the article's content broadly and in–depth; 2) Critique skill, for instance, the emphasis of students' evaluations on their assigned papers and drawing out the papers' weaknesses and strengths in relation to data, information and applied research methods; and 3) Collaborative and presentation skills on a topic of interest, the ability to interact and discuss with a clear and concise flow of presentation. Table 2 and Graph 1 show number of students in each class and students' marks.

Table 2. The study sample, outlining numbers of undergraduate and postgraduate students who participated in the project.

Year	Number of students	
	Undergraduate	Postgraduate
2008	-	26
2009	-	56
2010	-	49
2011	-	26
2012	23	28
TOTAL	23	185



Graph 1. Students' result before and after SOAR Framework

7. RESULTS - **STUDENTS' FEEDBACK**

The university has a standard survey for students to review subjects. To evaluate SOAR, we used the standard survey to develop a SOAR efficiency and effectiveness survey which was distributed to 23 undergraduate (UG) and 159 postgraduate (PG) students from 2009 to 2012 (Table 1). We applied content analysis approach [17] and used NVivo software [18] to analyse students' responses looking for similar comments. We summarised comments from UG and PG students into four categories: 1) article topics; 2) paper discussion; 3) questions posted on the forum; and 4) oral presentation.

All (23) UG students in 2012 made positive comments about the articles: *'Topics are current, significant, clear and interesting'*, *'good knowledge'*, *'It sharpened our thinking'*, *'Topics are thought-provoking'*. 98% (157) of PG students also felt positive: *'Topics give us business aspects of a technical field'*, *'They broadened our knowledge of IT strategies'*.

Regarding paper discussion, more than 80% of UG students found the session was *'informative'*, *'engaging'* and *'a lot of feedback'*. Some UG student feedback was similar to the PG student feedback, while other two UG students did not answer this section. PG students commented *'team dynamics were unique'*. Students agreed that the process involved two-way discussion and they *'enjoyed it'*. They also believed that such discussion helped them *'not only get to know each other better but also able to share my experience and knowledge within the group level and class level'*.

Regarding the questions posted on the forum, UG student surveys showed a dichotomy. 10 local students felt *'questions are a good help to think critically and relate to the paper and real life experiences but proper guidance on structure for writing question is important'*. However 13 international students commented *'As English is not our first language, our questions have not been proofread and non-presenters received wrongly interpreted our questions' meaning hence we get different answers from them'*. More than 80% of PG students, who are more advanced and mature, commented *'questions are challenging in some aspects and some further reading is necessary'*. Moreover, they found peers' questions did help them improve their critical thinking.

Despite over half the UG students struggling with written English, there were mainly positive comments regarding oral presentations. 50% of UG students reported they really enjoyed presenting as it was their first time presenting their ideas to a panel: *'We have no experience for presentation. We learn many useful tips how to make a good presentation from the subject coordinator'*. On the other hand, PG students, who may have been more experienced, had limited comments on the presentation. 98% of PG students felt presentations *'stimulated discussion in class and feedback from the subject coordinator'*. They also commented that *'there was a lot of information'* and *'argumentative and critical evaluation'*. They felt that they learned how to *'build oral communication skills, negotiation skills and analytical skills, as well'*. 98% of postgraduate students agreed that the presentation structure helped them to understand and improve reading scholarly papers.

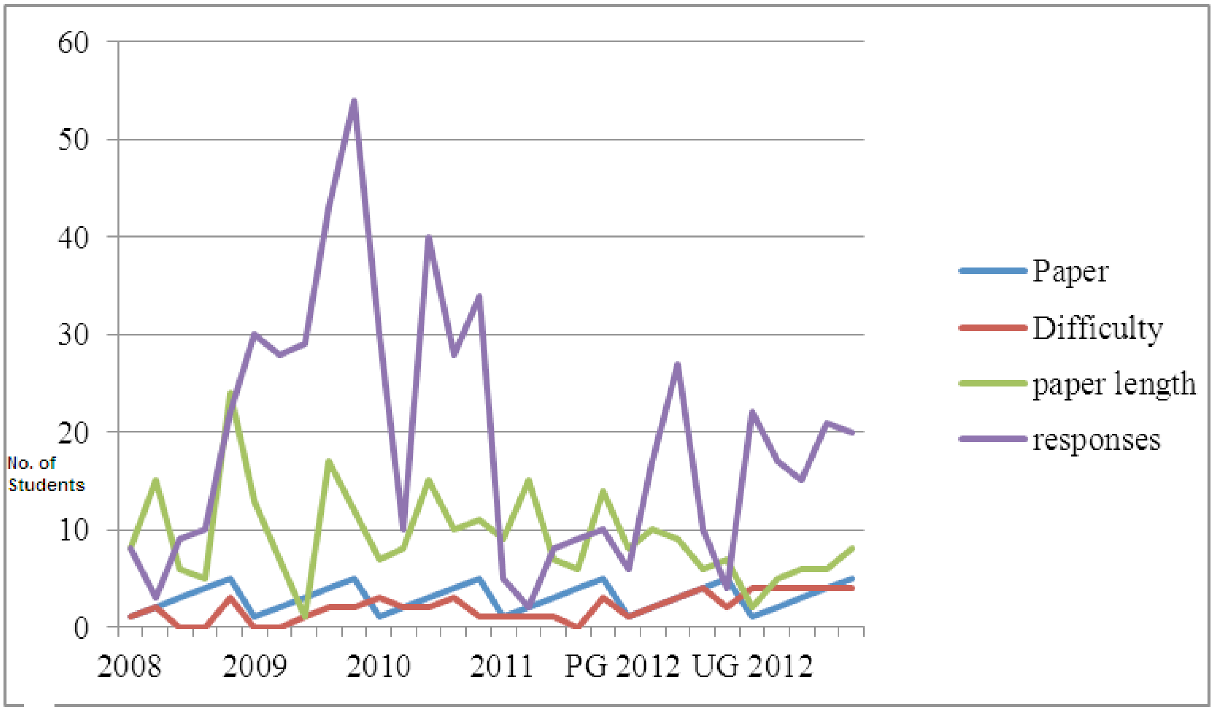


Figure 2 Articles Comparison

Interestingly, we did not find that difficulty or length of the papers affected students' interest in understanding the topics or their motivation in their course, for either UG or PG students. We also did not find any significant correlation between paper difficulty and length on learners' reading ability while using SOAR. Our findings therefore show that paper difficulty and length were not relevant to achieving better learning outcomes according to our sample of volunteer participants (Figure 2).

8. CONCLUSION AND FUTURE WORK

Based on the positive feedback we received and the academic outcomes of the students, we are confident that the SOAR framework can assist educators and students to achieve good learning outcomes. From our data analysis, SOAR can be used with both undergraduate and postgraduate students. However, a development workshop on language and communication skills must be given to undergraduate students to improve their writing and speaking, especially students for whom English is not their first language. Further work will continue to validate SOAR in other subjects, faculties and universities to evaluate effectiveness and efficacy.

ACKNOWLEDGEMENT

This framework was developed under an internal university grant for improving and seeking higher learning and teaching quality.

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Intercultural Communicative Competence Development

In

Teletandem Learning Context

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Abstract

It has become undeniable fact that technology has a dramatic influence on all fields of life and language learning is not excluded from such a process. For Kern (2006), the real impact of technology could be recognised from the relative absence of "'BALL' (book-assisted language learning), "PALL" (pen-assisted language learning), and "LALL" (library-assisted language learning)" due to the relatively high use of 'CALL', computer assisted language learning. With that in mind, teletandem as a form of telecollaboration through which online intercultural interaction between or among learners from different countries of different cultures and languages is considered important to enhance learners' mutual intercultural understanding, see Vygotsky's (1978) 'ZPD'. Such a learning context is based on a sociocultural approach that defines learning through societal interaction and collaboration in the online social contexts such as, email, web-based message boards, video conferencing, etc. In view of that, the present study aims at tackling the significance of using teletandem as an autonomous telecollaborative learning context that develops learners' intercultural communicative competence with some relevant references to Solyia's, jointly with the MIT's Saxelabl Social Cognitive Neuroscience Laboratory (SSCNL)for measuring the impact of this program, '2.0 Exchange' or 'Connect Program'. To achieve that, the study falls in five sections: the first discusses the impact of telecollaboration as a source of multiliteracy on learners' intercultural communicative competence and how it is related to interlocutors' identity, the second deals with the pedagogical implications of being involved in teletandem learning context, the third is to discuss learning autonomy in relation to teletandem', the fourth is to show the teacher-learner roles in such an e-communicative learning context, and the conclusion finally sums up the findings of the paper.

1. L2 Intercultural Competence and Telecollaborative Multiliteracy

L2 competence has been traditionally investigated and defined within the scope of linguistic mastery. This nevertheless does not impede some scholars to gradually move away and delimit this idea to include the sense of being able to discuss and express new issues related to cultural issues. For Pollak (2010:5-6), this type of competence could be acquired only in situations of variable and creative domains. As a dynamic process of transforming knowledge into action, L2 learners' intercultural competence requires both knowledge and internalisation of cultural values. In view of the internet literacy, telecollaborative activities which involve two or more international classrooms could be seen as a source of knowing other's linguistic and cultural systems. This might help them to be familiar within the already established system, 'socialisation' (Nieke, 2000:44; cited in Pollak, ibid: 8)[1]. In other words, this kind of online communal familiarity paves the way for establishing cultural and linguistic awareness in the process of intercultural competence formation. Accordingly, interculturally-based projects are potentially significant to enhance learners' cultural information and understanding of others' cultural views in a particular context (Kern, 2006:197-8). Furthermore, with the aim of developing language skills and intercultural communicative competence, telecollaborative learners "[…] become intercultural speakers or mediators who possess the linguistic skills and intercultural awareness necessary to allow them to interact effectively in a foreign language with people from cultures that are different from their own" (Guth and Helm, 2012:43). To make a shift in the 21st century world of education, Soliya, working with the MIT's Saxelabl Social Cognitive Neuroscience Laboratory (SSCNL), has presented a combination of practices for learners to resolve and discuss their cultural differences via the use of novel media technologies. For Soliya and MIT's SSCNL, it is vital for students to have a rich cross-cultural experience to be an educational part within their curricula. This could be addressed and achieved through Soliya's 'exchange 2.0', 'Connect Program' that is founded in 2011 by iEARN, Global Nomads Group & Soliya.

Failing to do that, it could be attributed to the participant's inability to understand cultural interdependency between 'Self' and 'Other' throughout interaction, as in (Bolten, 2001: 25; cited in Pollak, 2010:13). This, of course, represents a shift to the traditional belief in the foreign language learning which used to rely on the dominance of the target speakers' linguistic system, 'nativism' (see, Byram and Zarate 1998: 10). Such a change could implicitly mean that modifying computer culture no longer lies in the hard or software processes but rather it is basically connected to the increasing number of users of different languages and cultural backgrounds. In other words, being different from face to face contexts (Ellis, 2010), online communication and cooperation essentially need electronically multi-literate learners (see Guth and Helm, 2012).

Being aware of the linguistic and cultural varieties in the community and as an expansion to the language-based view of literacy, 'multiliteracy', according to (New London Group, 1996) has become necessary to consider. The increasing development of the World Wide Web has become the source for a new trend to "[. . .] extend the idea and scope of literacy pedagogy to account for the context of our culturally and linguistically diverse and increasingly globalised societies; to account for the multifarious cultures that interrelate and the plurality of texts that circulate [. . .] and to account for the burgeoning variety of text forms associated with information and multimedia technologies" (New London Group 2000: 9). With the 'Social Web' activities in mind, learners could be provided with the chance to contact each other all over the world. This could consequently assist them to achieve 'multi-cultural contact' (Guth and Helm, 2012:43). What is necessary for this on-line interculturally-based interaction is critical awareness. This means that telecollaborative to be critically aware of discriminating what is real from what is technologically portrayed. In addition to the necessity of adapting the sense of change in communication with the world, such a process of questioning the authenticity, accuracy, and reliability of what they face expresses the learners' need "[…] to become discerning and critically literate in relation to the media and the internet […]" (Pollak, 2010:3). In view of that, Soliya's participants could be provided with the required skills to collaboratively address the expected challenges. In other words, Soliya generation is prepared to be 'future leaders' of critical thinking, cross-cultural communication and collaboration skills to achieve the sense of communal globality as since 2003 Soliya's 'Connect Program'

1. Most of the references which are referred to as cited in Pollak (2010) throughout the present study are written in languages other than English.

has been implemented in over 100 universities in 27 countries across the Middle East, North Africa, South Asia, Europe and North America.

2. The Pedagogical Implications of Intercultural Communication

Being a dynamic process as a result of the inevitable interculturally transmitted attitudes, information and norms, culture could not be identical to language (Bolten, 2001: 38-39; cited in Pollak, 2010:12). This implies the idea that acquiring a language does not mean acquiring the culture of its society (Hofstede and Hofstede, 2005: 328). This of course does not negate the fact that both language and culture could be seen as integrative parts of the individual's identity. Considered as learnt 'software of the mind' or 'mental program', culture is furthermore used to be parallelised with the notion of 'nation' through the use of 'ethnocentrism' (Ibid: 2-5). The effect of evaluating people according to the criteria of 'nation' related values to form social group's membership might additionally lead to the rejection of others'. This sometimes expresses the individual's difficulty in avoiding his position or standpoint (Ibid).

However, in view of the 'cultural relativism' perspective, this is untrue as 'self-idealisation' in the sense that cultural difference does not indicate the lack of the same value, or being evaluated through one's familiarity judgement. This means that experiencing such a heterogeneously dynamic culture reflects the sense of being in a 'Navigation system' (Földes, 2007: 29; cited in Pollak, 2010:7). Accordingly, the intercultural learner is seen as a mediator who might clarify cultural differences through this kind of lexical or textual negotiation. This mediator is, for Byram and Morgan et al. (1994: 157), able "to relativize and understand himself and his own culture and to negotiate on the basis of this understanding". Such a communicative capacity could be attributed to the constant confrontation of numerous cultural variables as people are not confined to one speech community or interactional fields. Besides, the inevitability of this cultural variety might be mediated through newspaper articles, fiction, or any other spoken or written discourse of interaction, which could be used as a widely public means of intercultural transmission of information (Nieke, 2000:193; cited in Pollak, 2010:8).

Linguistically speaking, learners' meaning negotiation might represent the possible means for them to be interculturally familiar with the communicative difference(s), e.g., greeting negotiation that takes different forms, cheek kissing or handshaking, etc. (Pollak, 2010:15-6). This might come to some extent with the idea that "[language] plays a crucial role not only in the construction of culture, but in the emergence of cultural change" (Kramsch, 1996: 3). Such a continual scheme of change involves the integration or replacement of new values with the previously adapted ones in the individual's cognitive space for the sake of 'self-identity' (Libben and Lindner, 1996: 13). Nonetheless, learners' understanding of the sociocultural meanings of the target language does not always suggest changing their first identity to be an exact copy of the natives', but it simply indicates the interaction of both to avoid the cultural gap (Pollak, 2010:36). Learners' telecollaborative intercultural communication as a product of cognitive, attitudinal and communicative process might hence be 'non-reflective' in terms of knowledge gathering and language practice, or 'reflective' for the imbalance evaluation, or 'mature' as a conscious shifting of views for future planning (Stickler and Emke, 2011).

Pedagogically speaking, according to Mao's (2009:145) view, the main aim of considering culture in the L2 learning process is to 'nurture' learners' intercultural competence as a communicative function of language. It is also stated that "[l]anguage learning helps learners to avoid stereotyping individuals, to develop curiosity and openness to otherness and to discover other cultures" (Council of Europe, 2008:29). As shown earlier, this means that participants could negotiate meaning of each other's world in cross-cultural communication. This implicitly indicates the idea that culture in both interculturality and cross-cultural communication is not embedded in either of the two participants' culture but related to each other (Reuter, 2004:252; cited in Pollak, 2010:16).

As findings of three qualitative studies concerned with EFL classes in a German university using different technological communicative tools as email, web-based message boards, etc., to interact with their partners in Ireland and the USA, O'Dowd (2007:146) has additionally reported that telecollaborative activities potentially enhance the process of improving students' intercultural communicative competence where they could provide those learners with various sources of knowledge that traditionally culture-related materials could not. To promote intercultural understanding, it is accordingly necessary for the learner to be aware of other's identity and deeply understand that to avoid the illusion of one's universal culture. This of course positively influences learners' insights and thinking of both cultures. In line with that, Soliya's 'Connect Program' teletandem participants discuss some issues related to identity, religion, culture, and other social-political ones. This encourages those members to freely share their culturally based views. Therefore, such a process expresses the inability to exclude learners' culture from language learning or teaching process, see (Pollak, 2010:48).

Moa (2009:147) likewise stresses the importance of keeping the learner active for revealing and assessing cultural similar or different norms, which achieves Byram's (1999) 'skill of discovery and interaction'. With the use of intercultural telecollaboration, learners could be provided with a sort of intercommunicative activities, which suggests the idea of encountering 'interculturality'. If supportive, this kind of interaction might enhance interactants' intercultural competence. As a result, online multilingual and cultural class activities could be useful for learners to enrich their experience. As mentioned earlier, such a rich leaning environment is a space for learners to be culturally mediated to develop their intercultural competence (Pollak, 2010:38).

3. Autonomous Learning in Teletandem Context

Without being controlled by the teacher, learners are seen as social agents who could apply what is acquired independently in various situations. This autonomous learning is ideally basic to Byram's (1999) 'savoir-apprendre'. To transform experience for learning, Byram (1997:69) further confirms that "[…] learners must become autonomous in their capacity for refining and increasing their knowledge, skills and attitudes". This means that intercultural exchange by itself does not necessarily fulfil mutual cultural understanding of others, see (Kramsch and Thorne, 2002) and (Belz, 2003), due to the variability of communicative genres, medium, and linguistic style (O'Dowd:2007).

Learning autonomy is therefore necessary in the sense that it "[…] is [a]part of a wider development in education that aims at preparing young people for lifelong learning through the ability to organise and direct their own learning inside and outside the school context (Camilleri, 1999: 5). Brookfield (1980; cited in Palfreyman, 2006) hence states that how people learn outside a formal educational setting does not simply reflect the idea of individualism in learning, but rather it significantly shows networks of some other people acting as models for those learners, feedback and scaffolding sources, see Vygotsky's (1978: 86-7) 'ZPD' below, which necessitates the role of the community as a base of knowledge. This could entail that learners' 'willingness' to vary his communicative strategy to keep pace with variety of the intercultural discourse community might be the key factor in creating and developing learners' cultural communicative competence (Hanna and de Nooy , 2003; cited in Kern, 2006:198). Such a discourse membership could be achieved through learners' participation in teletandem learning' as a sort of telecollaborative context, see O'Rourke (2007:43-4). It however depends on learner's determination, which is of great value in developing learners' intercultural communicative competence through making learner's different views and ideas open to discussion and reflection. Making one's and other's identity explicit for investigation and feedback is also important for reflection and stimulating learners' emotional aspect in intercultural learning (Pollak, 2010:53).

To be of more educational benefit, teletandem could connect learners from all over the world to share knowledge that helps them to see things from different perspectives, 'interpersonal networks' (ibid: 98). It is a virtual environment that allows learners to transform, challenge, and mediate their cultural views about 'epistemic understanding'; moving from the black to the white viewpoints of things (Wilson and Ryder 1998). As a base for cultural mediation, its original form is a face-to-face learning that aims at improving learners' linguistic competence; 'one-to-one arrangement' (O'Rourke, 2007:43-4), which would be generally considered 'a promising complement to the foreign language learning' (Pollak, 2010:67). With the possibility of using their native language or a lingua franca, grouping learners of different L1 and C1 in the same context, and encountering the same difficulty in interaction, teletandem plan could facilitate intercultural learning. This kind of leaning environment is expected to be a practice of 'reciprocal' scaffolding between learners in terms of the possible involvement of the native (O'Rourke 2007: 43) to be the 'trusted' source facilitator, see for example (Stickler and Emke, 2011).

As far as the importance of the language used in such a kind of intercultural interactive reflection is concerned, it is hard to separate language from one's life for certain psychological perspectives. As stated earlier, it is not necessary to rely on 'nativism' i.e., teletandem interaction could be established via 'plurilingual' or second language speakers (Byram and Zarate, 1998:10). This means that learners might sometimes recourse to the L1 because of the inevitable challenge faced in translating experiences of the native language settings (Risager, 2006: 157). Moreover, a particular type of structure or content of the interaction is sometimes out such a learning context due to its reliance of the learner's 'self-awareness' and autonomy (O'Rourke 2007: 46-9). Thus, learners in e-tandem context have to "[…] monitor and evaluate both objectives and means […] in the light of experience" (ibid: 46). This also explains the significance of 'reciprocity' in arranging such intercultural learning environment. Participants should support each other to enact as both: learners and experts. Nevertheless, to avoid transmitting a blurred view of the home cultural facts, critical cultural awareness is required. Generally speaking, tandem participants should not be considered the representatives of the foreign culture (Pollak, 2010: 96). This indicates the idea that it is crucial to avoid the essentialist view in this diverse and autonomous intercultural learning. Moreover, learners might differ in their aims and motivation, which could be the clue for failure to intercultural miscommunication (Woodin, 2001:48). It basically suggests the high predictability of the cultural inequality which might cause difficulties in participants' 'asymmetrical communication' and vice versa. Such intercultural challenges could be attributed to any of Auernheimer's (2008: 57; cited in Pollak, 2010: 13-16) four categories: 'power imbalances', 'different cultural scripts', 'common historical experience', and 'stereotypes and prejudices'. Taking the question further, (Knapp, 2008: 85-6; Pollak, ibid:16) highpoints the impact of language proficiency in affecting communicative progression or understanding where cross-cultural interaction is usually featured of the unbalanced language level due to the interactants' possible use of a foreign language or a lingua franca.

Accordingly, for Byram (1999:19), the intercultural communicator should be characterised by three skills: 'savoir-comprendre', i.e. to be skilful in interpreting texts, its relation to oneself, 'savoir-apprendre', that means the effective detection of previously unfamiliar attitudes; information and scripts, and 'savoir faire', which is the real course of an intercultural communication. Moreover, he (ibid:370) states that education is basically implied in the individual's 'critical cultural awareness' which means the "ability to evaluate critically and on the basis of explicit criteria perspectives, practices and products in one's own and other cultures and countries". This indicates that interlocutors' competence relies on behaviour, attitudes and knowledge. Additionally, to develop that kind of competence, less capable individuals could cover the gap in their knowledge through interculturally telecollaborative communication with more competent peer. Individuals could construct knowledge in such cultural mediated collaboration with foreign partners. As 'bud' or flowers' not the 'fruits' of the mental development, this is referred to as 'the zone of proximal development','ZPD', by (Vygotsky 1978: 86-7).

4. Teacher/Learner Roles in Teletandem Learning Context

As an international telecollaborative context, teletandem is viewed as a potential source for improving learners' target language, intercultural awareness, and computer literacy (Belz & Thorne, 2006). For some scholars, among others (Teles, 2000 and Canagarajah, 1997; cited in Basharina, et al., 2008:277), the instructor's role in such a learning activity is a useful guide for assisting learner autonomy, supporting learners' perception of the online environment that eases teachers' workload. This change is characterised by moving away from the 'traditional IRE', teacher initiation, student response, and teacher evaluation, which means learners are able to interact according to their personal styles. In other words, in (in)formal online contact, for instance, participants might have the role of facilitators or experts depending on their information of the discussed topic though in some studies have generally approved the instructor presence is required, particularly in international telecollaboration (Ware and Kramsch, 2005) and (Basharina, et al., 2008:278). For Belz (2003:92), the instructor should be involved especially in "discerning, identifying, explaining, and modelling culturally-contingent patterns of interaction in the absence of paralinguistic meaning signals". Therefore, teachers' authority could be required depending on the source availability to learners in such a sociocultural learning context (Thorne, 2003). Based on a social network theory, it is additionally important for the teacher to be aware of the fact that teletandem intercultural exchange aims at achieving 'long term objectives'. This could have its impact on establishing certain relationships between interlocutors of various contents in terms of topic, focus, quantity, quality, and direction. It could gradually lead to knowledge accumulation between individuals through modelling language use or learning support and encouragement. Being related to community, identity-related data and its development have become important to investigate and see its influence on learners' intercultural communicative competence (Pavlenko and Blackledge, 2004). Consequently, there are other aspects that might affect this process. Some could be ascribed to the class, family, or other social matters (Roberts and Kleiner, 1999; cited in Palfreyman, 2006: 353).

Accordingly, it is important for teachers to be careful about selecting the communication tool that is appropriate to the aim and content of that teletandem class interaction. They "need to be critically aware of the connections among technology, culture, ideology, and specifically about the ways in which technology amplifies and constrains aspects of language learning and research" (Chapelle, 2003: 9; cited in Kern, 2006: 201). In addition, they should recognise the fact that technology enables learners to familiarise what is unfamiliar, to reconceptualise sociocultural-based issues, which enhances learners' intercultural communicative competence (Kern, ibid). This therefore implies the idea that teachers are seen as facilitators or problem solvers in such a learning context. This necessitates the notion that they have to be well trained on this kind of technologically-based learning; how to question and describe one's home culture to be models for their learners (O'Dowd, 2007).

With that in mind, Soliya's 'Connect Program' is held by well-trained facilitators. Those facilitators have undergone minimally 20 hours training period guided by skilful trainers. The training program includes skill-building related activities such as listening, summarising, directing good questions, observing and addressing group dynamics, and working with online apparatuses. Some other activities related to trainers' 'self-awareness' to be able to discuss the faced challenges, relevance of the chosen academic materials and so on. This could be of significance for those who work in such technologically-enabled intercultural communication for the necessity of having some sort of experience on actual problems concerned with intercultural misunderstanding, see for instance (Guth and Helm, 2012). As teletandem instructors, they could also face some difficulties related to 'implementation stage', such as "project structure and assessment, research versus pedagogical agenda, ambiguity about instructor participation, and securing the participation of 'have-nots.'" (Basharina, et al., 2008: 298-9). It is therefore suggested that opposing ideas of this scheme should be made clear to participants by the instructor in addition to scrutinising the structure of the activity, learners' assessment, internet access, time commitment, facilitation styles, etc. Such challenges show the intricate nature of teletandem in which instructors of culturally diverted institutional contexts involved (ibid).

Tackling the teacher role could be highly connected to that of the learner. In the learning process, context and learners define each other (Lave and Wenger, 1991); i.e., "[…] the learner is embedded in society shaped by both innovative technology and cultural diversity […]" (Pollak, 2010:1). Consequently, information exchange, comparison, analysis, collaboration and product creation are, according to (O'Dowd and Ware, 2009), considered as major sets for telecollaborative learners to do in the e-collaborative context. For Guth and Helm (2012:47), this e-cooperation on product creation could be considered a highly difficult task because of the learners' need to the necessary intercultural competence and collaborative skills to be engaged in the teamwork in addition to online related information. To achieve that, Soliya's 'Connect Program' aims to provide learners with the chance to establish a deeper understanding of the others' views around the world on important matters and why they do, as in the students' access to the video project to reflect on editorial decision-making and the media impact on cross-cultural relations, see students' video portraying the 2008 conflict in Gaza as provided from APTN and Al Jazeera on Soliya's website. It could be seen as an opportunity for learners to have political discussion. As a result, this kind of program could achieve the 'operational', 'cultural', and 'critical' dimensions as 'new literacies' (Lankshear and Knobel, 2006; cited in Guth and Helm, ibid: 43).

However, this does not of course mean such an online interaction aims at finding a way to reach the world consensus about a particular issue. Instead, it might provide learners with the chance to see the world from others' perspectives. If this does not occur naturally, it is then teachers' responsibility to assist them to do that. This could generally express the intricate relationship between the teacher /learner role in teletandem as one of many other learning contexts. This complexity lies in the fact that it is difficult for the teacher to prepare learners for every situation they might encounter due to the unpredictability of that. Self-dependent learners could hence be seen as mastering unpredictable cultural and linguistic situations (Zarate, 1999: 11). In view of the learner-centred approach, the teacher is no longer seen as the answer provider for previously analysed information, but rather he has become mainly the supplier of the source of information which depends on the learner's decision of its importance (Planet and Byram 2000: 90; in Pollak, 2010). This could be recognised in Soliya Jordanian female student's feedback for joining Soliya's 'Connect Program' saying "Soliya allowed me to open the box that I was living in for a long time and see the world around me…".

5. Conclusion

Regardless of the difficulties that might be faced, it could be concluded that teletandem learning, as represented in Soliya's 'Connect Program', usually provides learners with the opportunity to be linguistically and culturally aware of the differences in the world. It might be defined as a learning environment that introduces learners with different multi-sources of knowledge. This potentially assists autonomous learners to improve their L2 intercultural communicative competence via supporting each other to overcome any interactional failure or misunderstanding. However, it should not be expected that participating in teletandem by itself could develop learners' intercultural communicative competence regardless other related supporting factors like collaboratively well-trained teachers to choose the right topic, participants and the possible means of such on-line interactions to achieve that aim.

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The Ability of Education to Build Bridges in a Post Conflict Scenario and the Role Technology-Enabled Education Can Play

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Abstract

This paper is a story rather than an academic paper. It is a story of the victory of peace and collaboration over violence and conflict. It is the story of a community's commitment to making life better for new generations and how the Blossims connection and technology-enabled education can play a role in this. It is the story of a community putting differences into a different paradigm – not ignoring them but rather embracing them and celebrating them. It is a story of respecting and celebrating difference and diversity. It is a living history story. It remains to be seen whether there is a happy ending, but the story thus far is worth telling.

1. Introduction

I welcome the opportunity to share with you the background to and structure of the Lisanelly Shared Education Campus (LSEC). I will outline the context within which the campus was developed and how the developing relationship with MIT BLOSSOMS will enhance its effectiveness as a bridge builder in a post conflict scenario. In particular, Technology-Enabled Education (TEE), which will be delivered primarily through our proposed "School of Making", will greatly enhance both the teaching and the learning experience as Lisanelly. The BLOSSOMS connection will also facilitate both teachers and students in reaching out to and learning from the wider world cultural community, a process which will be beneficial to all parties.

We would see the relationship with BLOSSOMS as an initial stepping stone to having teachers and students in Omagh become more familiar and comfortable with TEE. We would also see the campus developing relationships with other programmes which, like BLOSSOMS, would expand the range of benefits delivered to the project at Lisanelly.

2. Background

"The Troubles" in Northern Ireland lasted for more than 30 years from 1969. During that time more than 3,000 people were killed and countless more were injured, and live with their injuries to this day. It is not my intention to try to explain the complex background to the conflict. There are many excellent publications which will do this, if anyone is interested to read further on the subject.

However, I do wish to relate a little background just to serve as a context to the Lisanelly project.

Omagh has been a British Army garrison town since the mid 1800's. During the Troubles, in the 1970's, the military strength of the town was more than doubled. Notwithstanding that there was a significant military presence in the town, Omagh was relatively peaceful during the period, with little trouble between the communities.

At 2.30 on the afternoon of Saturday, 15th August 1998, a number of bomb warnings were received by a Northern Ireland TV station and a volunteer worker with a charity organisation *The Samaritans*. The warnings said variously:

"Bomb Courthouse Omagh, Main Street, 500 pound explosion, 30 minutes"
"This is a bomb warning, a bomb will go off in the centre of Omagh in 30 minutes..........about 200 yards up from the courthouse...........High Street, the main street"

A dissident terrorist codeword was given.

What we know from these warnings is that the bombers were not locals. They did not know Omagh, for there is no "Main Street" in Omagh. There is a short section of street called High Street, which is located close to the Courthouse. The real town centre in Omagh is centred round a street called Market Street which links to High Street and the courthouse.

The police officer to whom these warnings were communicated assessed, given the content of the various warnings, that there was a bomb in the general area of the courthouse and that this was the main area to be cleared. Police began *"to make a sterile area around the courthouse and then start pushing everybody back down, away from the courthouse, towards Market Street"*. Based on the information to hand this appeared to be a sensible approach. Shortly before the bomb was due to go off, the area around the courthouse was cleared to the extent that it resembled a ghost town.

Sadly, this apparently sensible course of action was one that herded people away from safety and directly into the location of the bomb. At 3.04 on a sunny August afternoon the bomb exploded and carnage ensued. The bomb killed eleven children, twelve women and unborn twins and six men. Two of the children were Spanish and the victims included Protestants, Catholics and a Mormon. The Omagh bombing was the worst single atrocity of the entire 30 year "Troubles".

In July 1997, nearly 30 years after the start of the Troubles, the Provisional IRA called a cessation of violence. Extensive negotiations followed culminating in the ***Good Friday Agreement*** of 10th April 1998. This is an agreement between the British and Irish Governments that includes, inter alia, the following provisions:

- Northern Ireland's future should be determined by majority vote;
- All parties will use exclusively peaceful and democratic means;

- An NI Assembly with devolved powers be set up along with a power-sharing Executive;
- A British-Irish Council and a British-Irish inter-governmental Conference be established;
- Release within 2 years of paramilitary prisoners of organisations on ceasefire;
- A 2 year target for decommissioning of paramilitary weapons;
- Republic of Ireland to abolish it's constitutional claim to NI;
- New legislation on policing, human rights and equality

Following the Omagh bombing and the outrage it caused, various other dissident terrorist groups announced ceasefires. Ironically, the Omagh bombing acted as a catalyst for the acceleration of the peace process and a significant reduction in military activity all leading to a further agreement, the ***Hillsborough Agreement***, in April 1999.
As part of the Hillsborough Agreement, the British Government undertook to hand over various redundant military barracks to the Northern Ireland Executive.................and thus the story of the ***Lisanelly Shared Education Campus*** began!

3. New Schools and New Ideas for Omagh

Omagh is a town of some 25,000 population but with a rural hinterland and catchment for the market town of some 50,000 persons. There are various organisations that are involved in the delivery of 2nd level post primary education in Northern Ireland. In most cases, schools are faith based around Catholic and Protestant education. Within these genres, there is a further delineation between schools with an "academic" approach to education, known as Grammar Schools, and schools with a more comprehensive approach to education.

Some local school operators, from both traditions, recognised the upcoming decommissioning of the substantial lands associated with the military barracks at Lisanelly as a potential location for new schools, in order to replace substandard accommodation. In the early stages the idea was for a co-location of schools with no intention or indeed thought of introducing any "shared" element. However, when the possibility arose that the British Government would "gift" the lands to the NI Executive for the development of a "shared education campus", the idea of exploring this concept began to develop.

There are currently 7 post primary schools in the Omagh area catering for some 4,500 pupils. A new "Integrated School" where Protestant and Catholic pupils are educated together, was established about 5 years ago in a new build facility. While this is a very popular school, for some in the community the idea of "integrating education" is a still a step too far. However, the idea of shared education, where each school retains its own individuality and ethos in a shared environment is a concept that is more achievable in the short term. Thus the proposed campus is being developed to cater for some 3,700 pupils in a variety of school types. This includes a "Special School and Resource Centre" catering for children from 4 – 19 who have both moderate and sever learning difficulties. Including this school fulfils another Departmental policy of increasing the integration between such schools and mainstream schools.

When approached by the school operators in the Omagh area, the Department of Education, Northern Ireland, supported by the Strategic Investment Board, recognised the unique opportunity to develop a state of the art Campus to deliver the educational needs of children from all communities within the Omagh area, through collaboration, co-operation and interdependence between participating schools, and the beneficial use such a facility could have for the wider community.

In 2010a budget of £3m. was set aside for the development of a Masterplan for the campus and Exemplar Designs for the participating individual schools. It was at this stage that I was appointed Programme Director to drive the project forward.

4. The Shared Education Campus Concept

Following consultation with many different stakeholders, the following **Principles of Sharing** were identified and formed the basis for the development of a Campus Masterplan:

- Each participating school has a core building where its own ethos and individuality is nurtured and developed;
- Pupils during Key Stage 3 (KS3), 11-14 years, receive almost all of their education within their core institution;
- Pupils at KS4 and KS5 receive a substantial part of their education in the shared facilities;
- Each participating school donates a % of its new build entitlement (i.e. the gross floor area it is entitled to in a stand-alone new build) into the "shared element" of the campus;
- Sharing is only proposed where it has an educational benefit.

Consideration of all of the above principles led to the development of the "shared schools" where economies of scale allowed the designers to propose facilities which could not be delivered if any school were to act on an individual basis.

The Shared Schools proposed are:

- **The School of Activity**

A centre of excellence for the teaching of sports, fitness and lifestyle;

- **The School of Performance**

A centre of excellence for the teaching of music, dance, art, design, drama and media studies;

- **The School of Making**

  A centre of excellence for the teaching of science, technology & design, and engineering.. It is in this school that the benefits flowing from the BLOSSOM Connection and TEE will have the greatest impact

These subject groupings were proposed because they have synergies and the intention is to create dynamic hubs which will develop into ***Centres of Excellence*** for the teaching of these groups of subjects.

For more background to the project and for a 3D Visualisation of how the Masterplan design has been developed you can follow the following links:

http://www.youtube.com/watch?v=LjUCABc5l3c

http://www.youtube.com/watch?v=2ygVvyI6Prs

5. LSEC and MIT BLOSSOMS

It was in considering how to develop a ***Centre of Excellence*** for the teaching of the STEM subjects in the School of Making that led me to make contact with MIT........... which has led to me being here today!

As Programme Director I feel it is my responsibility to bring as much additionality to the campus project as possible, almost as a reward to the community's faith in, and ongoing commitment to, the project. I am only too aware of the importance of the STEM subjects to local, national and global economies and the importance for today's students to have a good grounding in those subjects.

While there is already an excellent standard of teaching of these subjects in NI, there is always room for improvement, and linking with a prestigious organisation such as MIT, through the BLOSSOMS Programme, and through them linking the young people and teachers of Omagh to a global network of young people and teachers, can only bring benefits. The idea that the School of Making has a link to MIT BLOSSOMS may also attract more young people in the area to study the STEM subjects and this can only be good for the local economy.

There are a number of important strands to the role that MIT BLOSSOMS can play in the LSEC including:

- Reinforcing the importance of strong STEM teaching and learning at the campus;
- The programme will be the mechanism for bringing together STEM teachers from the different schools to learn about MIT BLOSSOMS and to learn a new active, problem-based teaching, that is the BLOSSOMS pedagogy;

- Bringing together STEM teachers from the various campus schools and encouraging them to work together in teams to develop their own BLOSSOMS lessons, thus introducing the idea of “team teaching” to the shared campus;
- The “lessons” created by the LSEC STEM teachers will be added to the BLOSSOMS website and shared globally, thus presenting a new, united face to the world;
- Through BLOSSOMS, connecting the LSEC teachers to other teachers around the world;
- Through BLOSSOMS, connecting LSEC students to other students around the world and facilitating them becoming more familiar with other cultures;
- Through BLOSSOMS, both teachers and students will gain access to additional TEE resources at MIT and will be encouraged to access other quality TEE resources available online.

We are at the very early stages of the development of this relationship but I am confident that it will be positive not just for the young people and teachers at LSEC, but for all BLOSSOM partners, worldwide, who will have the opportunity to engage with the young people and the educational workforce of Omagh.

6. Community Support

On being appointed, one of my first tasks was to carry out a public consultation exercise to “test the temperature” of community support for the project. We asked the community very direct questions as to their support for the project. I’m not sure what we would have done if they had said no, but in any event they didn’t! We asked them what sort of subjects might be shared, we asked them whether retaining ethos was important, we asked whether sharing might be different depending on the age of pupils.

The positive response was overwhelming, and this has continued through further public consultation exercises we have carried out and indeed through the ongoing public consultation via our website *omaghlisanellycampus.org*. (A copy of a typical questionnaire is contained at the end of the document.) The outcome of this public consultation exercise formed the basis on which we moved forward to develop the shared education campus concept and the Masterplan for the development.

We were very keen to engage with the youth of Omagh in particular, as they were the people who would be most affected by the proposed development – either directly or through their siblings, or as “future parents” of children who would attend the campus.

Interestingly, where we had some 70% support amongst the general community, the support for the project amongst young people is consistently well in excess of 90%, and the 10% of young people who are not supportive are not in fact anti the project but rather are attendees at the local integrated school who received a new build in the last 5 years at another location, so can’t actually be part of the campus in terms of a building presence. Their lack of support is actually a reflection of their disappointment at not being able to be a central part of the campus per se.

You might be interested to view a local youth production relating to the project:

http://www.youtube.com/watch?v=c1_LtidUrVA

When the idea of linking with MIT BLOSSOMS Programme with first mooted in the community there was an overwhelmingly positive response. The chance to be part of such a global Technology – Enabled Education initiative has galvanised those who have supported the project from the outset and in particular those who see that the delivery of education has, thankfully, moved on from the stale rote learning approach.

7. Conclusion

The LSEC is a challenging project, mostly because it proposes changes to the established way of doing things educationally. Northern Ireland has a good reputation in the delivery of education so some may feel that "if it's not broken, don't fix it". But the fact is that, in the interests of continuing the development of a peaceful and integrated community, things in the area of education in NI need to change. It is proposed at Government level to use the Lisanelly Shared Education Campus as a model for the delivery of a number of shared education projects across NI.

The availability of Technology – Enabled Education is a huge opportunity for students and teachers alike . I believe that linking with MIT BLOSSOMS will be a symbiotic relationship for LSEC and BLOSSOMS partners. The Minister for Education in NI, Mr. John O'Dowd, recognised the potential in this partnering arrangement straight away and it is with his enormous support that I am here today.

I look forward to working with MIT BLOSSOMS and its partners to bring the very best educational opportunities to the young people and education workforce of Omagh, and indeed I look forward to reporting to future LINC Conferences on the progress we will have made.

Lisanelly Shared Educational Campus

Feedback form

"An investment in the future of Omagh's children"

June/July 2010

This project involves the redevelopment of a former military barracks into a shared education campus for up to 6 post primary schools in the Omagh area. The co-location of all schools on a single site will increase opportunities for collaboration and sharing of facilities. As this is a project for the entire community in Omagh, it is important that local views and suggestions are shared and where possible incorporated into the design and master planning process. Please let us have your views and opinions by filling in this questionnaire.

1. Do you support in principle the development of the Lisanelly Shared Education Campus?

   ☐ strongly support ☐ support ☐ don't support ☐ unsure

2. Do you consider it is important to preserve the individual ethos and identity of the schools on the site?

   ☐ strongly agree ☐ agree ☐ don't agree ☐ unsure

3. Would you support the shared teaching between schools of some subjects for older pupils (15+) to ensure they have access to a greater variety of subject areas e.g. languages, sports, drama, etc?

   ☐ strongly support ☐ support ☐ don't support ☐ unsure

4. (a) Would you support the sharing of some key facilities between schools on the campus?

   ☐ strongly support ☐ support ☐ don't support ☐ unsure

   (b) If *yes* please tick which areas you believe could be shared.

   ☐ Sports facilities ☐ Library ☐ Information Technology
   ☐ Multi Purpose Hall ☐ Careers Suite ☐ Drama/Lecture/Dance
   ☐ Medical Support facilities ☐ Dining/Catering facilities
   ☐ Other. Please state________________________

5. The Design Team will also look at whether some of the shared facilities on the campus can be used by the community outside of school hours. Would you support these facilities being made available to the local community?

   ☐ yes ☐ no ☐ don't know

6. Please indicate which school(s) you are associated with now, in the past, expect to be in the future?

   ☐ Loreto Convent ☐ Omagh Academy ☐ Christian Brothers
   ☐ Sacred Heart ☐ Omagh High School ☐ Arvalee Resource Centre
   ☐ Other. Please State ___________________________ ☐ None.

7. Are you a

   ☐ parent/guardian ☐ member of school staff
   ☐ pupil ☐ other. Please State ___________________________

8. Are there any specific comments that you may have in relation to this project or have you any ideas for facilities that you would like to see on this campus?

   ____

   ____

   ____

Thank you

Please place your feedback form in the box beside the exhibition display. If you wish to post the form, please send it to LSEC FEEDBACK, C/o LSEC Project Office, Western Education & Library Board, 1 Hospital Road, Omagh, Co Tyrone, BT79 0A. You can also submit comments by email to lisanellyfeedback@sibni.org. Closing date for submission of questionnaires is 16th July.

Conditions for a Sustainable Online Master at CERAP

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Abstract
This article describes the recent story of the online Master Program in Peace and Conflict Studies of CERAP. Highlighting the necessary conditions for the development and sustainability of e-learning at CERAP. My goal is to share my own experience as e-learning coordinator in order to improve and to make e-learning at CERAP effective and sustainable.

1. Introduction

The Center for Research and Action for Peace (CERAP) in Abidjan (Ivory Coast) had officially joined the world of e-learning in January 2012 by offering a Master Program in Peace and Conflict. The idea of this Master Program is simple: to offer an education of quality from Africa to all. After one year, what have I learned from this pilot project as CERAP e-learning coordinator?

First, in a continent like Africa where universities belong to the state and where tuition fees are low, e-learning will reach a small number of students (wealthier). Why? Because students need to have frequent and reliable internet and email access to take the course. In addition, there is evidence that this type of training is ideal for motivated learners, who are able to self-manage.

Second, I have the firm conviction that a university does not offer an online quality course simply because it wants to . In other words, there are differences between teaching in classroom and online teaching.

Third, CERAP has announced plans to explore the e-learning to increase its visibility and find new teaching technologies. Such an undertaking cannot be sustained without certain conditions. What are these conditions? This is the subject of this paper.

This paper will be in three parts. The first one will focus on CERAP Highlights Timeline, the second will focus on the online Master, the third part will point out some conditions to make e-learning at CERAP sustainable.

2. CERAP Highlights Timeline

1962 CERAP, then known as INADES (Institut Africain pour le Developpement economique et Social a Jesuit social center) was founded in Abidjan.
1964 The Library was founded. Today it is one of the largest among French speaking countries' libraries which are exclusively devoted to social sciences in Africa. The main

catalog covers all the social sciences; collections are particularly strong in economics, sociology, political science and the social, economic and international aspects of history, etc.
The library is more than just a collection of books and journals; it is an ideal place to study with hundreds of study spaces and PC's, laptop points, a free laptop loan service, wireless access, group study rooms and photocopying and printing facilities. The library is a focal point at the school and used extensively by both students and academics.
2003 INADES became CERAP
2005 CERAP received accreditation from the Ivory Coast government to become an Institute for Higher Education.

CERAP is a Catholic Higher Education center sponsored by the Society of Jesus. As such, CERAP is dedicated to the ideals of striving for academic excellence under the inspiration of the Christian faith; it recognizes and affirms the importance of the principle of academic freedom in its pursuit of truth and in keeping with its Christian vision of the dignity of each human person. It welcomes and respects students, faculty, and staff from all racial, ethnic and religious backgrounds and beliefs.
From 2005 to now: CERAP offers a two - year Master Program in Ethics and Governance. The program has four specializations:

- International Human Rights Law,
- Ethics in Economy and Sustainable Development,
- Corporate Governance and Corporate Social Responsibility,
- Peace and Conflict Management.

The program prepares graduates for a professional career as an investigator and analyst in both the private and public sectors, both nationally and internationally. The degree is a required qualification to apply for doctoral studies in the selected specialization.
2012: Since January 2012 CERAP offers an online Master Program. It is taught in French

3. Overview of the online master program: how does this online course work?

The Master Program in Peace and Conflict Studies is a degree program that typically includes 25 students from more than 10 countries in Africa. The 15-month program includes core courses, optional courses, professionalizing activities, and the writing of a Master paper. The degree is assessed through coursework, examinations and a dissertation. It is designed in particular for professionals who wish to pursue advanced studies in Peace and Conflict Studies but may need to do so alongside their work or family responsibilities. It involves one period of internet learning as well as one session (residential) held at CERAP (Abidjan).

3.1 Residential

All Online Master's students are invited to attend a two-week residential session in May at CERAP in Abidjan. This gives them the opportunity to meet the academic staff and their peers with whom they have been working with on the internet throughout the year. The two week activities are designed to continue the personal and professional development they began during their online studies.

The two weeks also give them the opportunity to strengthen the networks that they have been online developing with their fellow students and the staff around the world.

During the CERAP Residential they will participate in a twoday peace resolution, simulation exercise. They will also undertake a three day personal development course as well as attend revision sessions for the modules that they have completed. Finally they will sit for their exams on the completed modules. The second week residential allows them to focus on specialist topics

3.2 Online Period: Modes of Teaching

In this section we will only discuss the pedagogical model of the Online Period because I discovered that the course design (how material is presented and the interactivity) is very important.

For the Online Period, during the first academic year 2012-2013, two modes of teaching were used.

The First Mode of Teaching

CERAP uses MOODLE as the learning management system (LMS). Two courses were offered each month. The format of the course was left to the discretion of the teachers.

As a result for some courses, students have access to our LMS and are provided with a variety of materials: lecture notes and academic journal papers. For other courses, instead of course materials, students are provided with slides.

There were neither video nor audio lectures.

There were no questions to test students' understanding of the course materials

For some courses, where there were discussion forums. According to feedbacks from the online courses, it seems that in spite of the real but often late help on behalf of the teachers and/or the other students, many learners had difficulty in finding answers to their numerous questions. Indeed, the forums abounded in questions, but are sometimes lacking answers

Dissatisfied with the first mode of teaching, I decided to set up a second mode of teaching during the same academic year

The Second Mode of Teaching

The course format consists of five components:

- The lecture notes
- PowerPoint slides
- Audio recordings (where available) of 20 hours taken from CERAP teaching class to complete the online course materials
- Key readings selected by the lecture from leading academic journals to compensate for the lack of course materials.
- Finally, the establishment of a mentoring system to track the progress of the students' papers without looking at their progress in the course.

Whatever pedagogical model was adopted, the difficult part is probably the grading of examinations. For The Master Program in Peace and Conflict Studies where the exercises consist of written work, it is not possible to automate the correction as in the case of sciences such as physics, computer science or mathematics where automatic evaluation system is fairly easy to implement.

In our case, the approach was to ask the student to go to an assessment center in which he must identify himself and where he is monitored during the examination. The problem is to ensure that the person who takes the test is the person who he claims to be. Then, we send copies to the teacher for correction. Once the copies are corrected, I organized a consultation of the copies between teacher and students via Skype (webcam)

4. How to make the online master program sustainable?

CERAP is adopting an e-learning as a way to meet the strong demand for higher education. This demand it simply cannot be met with traditional campuses and programs. This goal could be achieved only under certain conditions and it is important to keepthis in mind here.

a) Define a Mode of teaching

At this time I would suggest that CERAP implement the Coursera pedagogy:

- by translating into French the *Coursera Resource Guide* prepared by Vanderbilt University (http://cft.vanderbilt.edu/files/coursera.pdf) for the CERAP teachers.
- by choosing a formal course format for all its courses. Intellectual property will remain in the hands of CERAP as it is now. The material is covered over four weeks. Each week comprises lecture notes and a certain number of short video presentations (8-15 minutes).These presentations are followed by a quiz. The course ends with a final examination. The course tutor will also be available during week 4 to answer any outstanding questions from students. It is, indeed, necessary that the student is guided by expert tutors. Nothing replaces a trainedteacher who can monitor progress and propose solutions

b) Having trained staff in e-learning field

The first pedagogical model of CERAP shows that technology must remain at the service of education and not the contrary. The training should really be designed in the context of interactivity, which involves much work that is commonly known as instructional design. It and teachers will have to work closely.

This means that in practice CERAP must build a faculty preparation course. Two training solutions can be proposed: an online training or a workshop.

CERAP must strengthen its team by recruiting a person who holds a graduate degree in Computer Science (Master), an assistant and a production manager. In short, CERAP must have some instructional designers who mediate between technicians and teachers who make the connection between technology and pedagogy.

c) E-library

CERAP must establish a Digital Library in order to allow students to have access to the CERAP's electronic resources and online journals, which they are expected to use for some of the activities. This may be possible by subscribing to JSTOR or through partnerships with universities.

d) Financial resources

At first glance, an online course is cheaper than classroom teaching, because it removes the costs of classroom, books and, especially the presence of a teacher. It is error to believe so. Like any good training solution, e-learning's quality has a cost both technical (servers, application development) and pedagogical (teacher salaries and assistants animated tutorials, screenwriting courses and video recordings.). While the CERAP and tuition fees have funded the creation of the online Master Program in Peace and Conflict Studies, it is still not enough to finance all future developments. Increasing the tuition fees would prohibit many from the course

How to finance the e-learning at CERAP?

For now, there is no clear answer. I think CERAP can work with some universities to share some courses, course materials,and lecturer

CERAP could also organize a fundraising campaign

5. Conclusion

If all these conditions are met, online learning can be a good teaching tool. It also has the advantage to adequately meet the individual needs of the learner, allowing he/her to keep pace and choose the moments when he/she can go online. However, if these conditions are not met, the learning can be considered as a "gadget" giving the illusion that it is enough to click a mouse to learn.

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Blended Learning in Complex Environments:

Reaching Learners in the Field

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Abstract

This paper describes a project designed to improve multilingual humanitarian communication in the field through training non-professional field interpreters in a blended learning environment. Following on Moser-Mercer & Bali (2007) who reported on the results of a needs analysis for training humanitarian field interpreters in conflict zones, this paper discusses design and development of both virtual and blended approaches, overcoming connectivity problems, collaborative learning and contextualization of learning activities in some of the most challenging and complex environments (Sudan, Afghanistan, and refugee camps in Kenya). We conclude that a careful blend of sound pedagogy and reliable technology, ownership of the learning enterprise, and responsiveness to local infrastructure limitations are critical elements in enabling skill and knowledge acquisition in the field.

1. Introduction

Conflict resolution and conflict transformation imply that deep-rooted sources of conflict are addressed and transformed. This suggests putting an end to the pursuit of incompatible goals by different groups or actors, whether this pursuit involved armed and violent conflict or remained at the level of a latent political conflict, with most major armed conflicts today being hybrid struggles that spill across the international, state and societal levels. All conflict resolution and subsequent transformation requires negotiation and the ability of suppressed or marginalized individuals or groups to articulate their interests; it requires challenging existing norms and power structures with a view not only to resolve the conflict, but to ensure that through peace-making, peace-keeping and peace-building future conflicts are being prevented (Ramsbotham, Woodhouse & Miall, 2011).

Challenging and ultimately changing attitudes through mediation and negotiation in order to effect changes in existing relationships and establishing a balance of power requires parties to communicate social values and norms, cultural and political beliefs and to overcome deep-seated mistrust. In most if not all conflicts the parties do not speak the same language, nor share the same culture. When third parties become involved in arbitration and mediation they bring with them yet another language and culture and usually impose it as the language of negotiation, obliging all parties to either speak that language, usually English, or rely on interpreters to support the communication process.

As conflict resolution efforts are deployed at a higher level, there is usually a humanitarian crisis to contend with on the ground, with access to geographical regions to be negotiated by organizations trying to assist the local population by supplying food, water and sanitation. Most humanitarian organizations do not have immediate access to language staff that could assist them capably in negotiating access and supporting refugees and internally displaced persons. In complex emergencies, with military operations being carried out while natural disasters and/or famine ravage a region, communication needs are exceedingly difficult to meet.

Prudent use of limited funds dictates priorities and in zones of humanitarian disaster and conflict the list of priorities is long, with language and cultural needs usually relegated to last place. Study after study recognizes the need for humanitarian action to engage with locals in order to build the trust that is essential for long-term solutions. As the humanitarian enterprise becomes more and more institutionalized, with targets to meet, internal procedures to respect and at times highly political agendas to pursue, its ability to engage on the ground beyond providing immediate, front-line relief is jeopardized (Donini, 2012). The prevailing English-only approach reinforces the image of humanitarian actors being subservient to their organization's mission and short-term goals, rather than in understanding the complexities of the local context and leveraging local resources to develop culturally-embedded and consequently more lasting solutions.

Multilingual and multi-cultural communication capacity in the field thus emerges as one of the most powerful ways to support peace-making, humanitarian action and conflict prevention. The approach to capacity-building must thus address the immediate and urgent needs of humanitarian assistance on the ground, as well as those of higher-level negotiations and ultimately transitional justice and development.

2. Virtual learning in complex environments

Over the past decade all major humanitarian organizations have embraced virtual learning in various ways in order to meet the training needs of their staff at headquarters and in the field. Engagement of local staff, however, has increased more significantly only in recent years, and local staff have thus not had automatic access to the learning resources deployed by the organizations on their own platforms. Depending on the contractual relationship between the local staff member and the organization (regular staff, temporary staff, incentive worker, etc.), local staff continue to face barriers when it comes to accessing learning resources, either because they are not considered regular staff, and thus not given access to the organization's intranet, or because the learning resources are available only in the working language of the organization (mostly English, in some cases English and French, or in English and Spanish), but not in one of the local languages, or because the learning content does not address their needs on the ground.

LINGOs (www.ngolearning.org), a not-for-profit consortium of over 75 international humanitarian relief, development, conservation and social justice organizations that share learning resources and experiences has served as a central contact point for private sector organizations that are interested in assisting the sector but want to see their contributions of software, courseware, systems and services be leveraged across many organizations. LINGOs operates a Learning Management System with courses on leadership and management development, IT, project management, stress management for humanitarian workers, personal safety and others. LINGOs is able to provide free and/or subsidized access to a number of learning tools to enable organizations to develop, launch and maintain technology-assisted learning strategies. Member organizations thus save time and resources in putting learning content on-line and while they can share available content, the responsibility to meet specific needs on the ground remains with the aid agency.

Another training content provider is the Inter-Agency Standing Committee (IASC; www.humanitarianinfo.org), a forum for coordination, policy development and decision-making involving the key UN and non-UN humanitarian partners. IASC was established in June 1992 in response to United Nations General Assembly Resolution 46/182 on the strengthening of humanitarian assistance. In December 2011 the IASC Principals endorsed the following five commitments for leaders of humanitarian organizations: 1) Demonstrate their commitment to accountability to affected populations; 2) Provide accessible and timely information to affected populations, so that they can make informed decisions and facilitate dialogue between an organization and its affected populations; 3) Offer feedback and complaint mechanisms; 4) Enable affected populations to play an active role in the decision-making processes that affect them; and 5) Involve affected populations in the design, delivery and evaluation of programs. Clearly, all of these commitments require humanitarian staff to communicate with the recipients of aid.

ELRHA (Enhancing Learning and Research in Humanitarian Assistance - www.elrha.org) has been addressing the professional development needs of individual humanitarian workers through consultation with over 2000 stakeholders around the globe. The ELRHA scoping study identified the major problems stopping the flow of trained people into the humanitarian sector and was received enthusiastically by the people it consulted on the issue of professionalization in the humanitarian sector. ELRHA focuses on building partnerships between institutions of higher education and the humanitarian sector with a view to matching the sector's needs with program offerings in higher education.

This short review of some of the major content and e-learning providers in the humanitarian sector illustrates that the focus is on preparing humanitarian leaders and workers for assignments in the field and on offering continuing staff development options for improving operations in the field. The emphasis is thus on transmitting knowledge that is applicable to a large spectrum of humanitarian contexts. Most, if not all of these learning resources are being accessed on organization-specific platforms whose connectivity requirements can usually only be met when working in medium to high bandwidth environments with uninterrupted internet service (headquarters, regional centers, or compounds in the field).

3. **Skill-building in complex environments – the case of interpreting**

When communicating with the local population humanitarian actors require the services of interpreters as they rarely speak the local language. Interpreting denotes the oral mode of transferring messages from one language to another, while translation refers to its written form. Interpreting can be done consecutively, either one sentence at a time or several sentences together with the interpreter taking notes to support memory, or simultaneously with the interpreter providing the rendition in a synchronous fashion within seconds of the original speech. The cognitive challenges of interpreting have been well documented and developing expertise requires consistent and deliberate practice with feedback to be provided by experienced practitioners on a regular basis. Given the variety of ways in which people express themselves, the input to interpreting cannot be limited to a fixed number of sentences a trainee should learn to interpret, and skill-building thus requires trainee-trainer/tutor interaction.

Moser-Mercer & Bali (2007) and Kherbiche (2009) reported on the basic needs and challenges encountered by interpreters working for humanitarian organizations in the field. The results of these needs analyses fed into the development of two virtual training courses for ICRC interpreters working in Pakistan, Afghanistan, Uzbekistan, Sri Lanka and the Occupied Arab Territories. Course content and delivery modes were supported by InZone's VLE, a proprietary platform developed by the Interpreting Department at the University of Geneva which is built around the pedagogical concepts of socio-constructivist and problem-based learning (Class, Moser-Mercer & Seeber, 2004). The three learning modules that made up the basic course (Introduction to virtual learning in the field, Ethics in humanitarian interpreting, and Skill-building in consecutive interpreting) were vetted by ICRC prior to being launched. All content was duplicated on DVDs and delivered via diplomatic pouch as back-up for use in case of poor connectivity to ICRC field offices in the above-mentioned countries. The time allotted to completing the three modules had to be extended several times as the demands of the field made it difficult for interpreters to meet the various deadlines. Both courses were carefully evaluated using a multi-stakeholder approach with feedback received from learners, trainers, ICRC users and ICRC headquarters (Moser-Mercer & Class, 2010).

The outcome of this evaluation informed the design and development of a new basic course for humanitarian field interpreters working for UNHCR in Nairobi and Kakuma Refugee Camp in Kenya, and in Khartoum and the refugee camps in and around Kassala in Sudan. The major challenge identified in the above-mentioned evaluation was release time for interpreters to engage in virtual learning, as they were not attending a face-to-face course and thus continued to be on call for work. Technical challenges included unstable internet connections that obliged the course designers to script activities to last no longer than 20 minutes; difficulties for trainers to provide substantive feedback on interpreter's note-taking skills for consecutive interpreting which were subsequently solved by training interpreters to use their cell phones to take pictures of their notes and to upload JPEG images to the VLE for trainer feedback; and preparing sound recordings of about three minutes length and subsequent uploading of learners' interpretations which required the preparation of a short guide to using open source software for recording MP3 files and for uploading them into the VLE. Among the major advantages noted by ICRC participants was the ability to have regular access to expert trainers, and to share experiences and benefit from a peer network across conflict zones through the VLE platform and the encouragement of collaborative learning.

In adapting the basic course to new humanitarian settings the course developers paid particular attention to lessons learned: 1. Organizing content and designing exercises in a way that would require limited internet connection time (maximum 20 minutes per activity); 2. Repeating needs analyses when offering the basic course to new humanitarian organizations in order to ensure continued contextualization of all learning content to fit the organization-specific work environment; 3. Gathering detailed information from all course participants about individual internet connectivity and the devices available to them for learning (desktop, laptop, mobile phone); 4. Setting clear deadlines and enforcing them to keep all learners registered for a particular course on schedule and allow for more collaboration, which is vital for skill-building and ownership of learning; and 5. Moving from an all-virtual approach to a blended format with trainers covering certain learning activities in the field in a face-to-face setting, and the balance of the modules being delivered on-line in the VLE.

The switch from an all-virtual to a blended mode presents a host of difficulties with regard to efficient delivery of learning in the field as trainers are required to deliver training under the protection of humanitarian organizations in conflict zones and must thus also be ready to contend with the vicissitudes of life in dangerous environments. However, the switch to blended learning even in complex environments has clearly motivated learners, allowed them to develop confidence and trust in their trainers, and has created the kind of personal relationship that is needed for critical feedback during skill acquisition to be properly assimilated. The learning cultures we encounter in conflict zones are decidedly traditional, relying on the authority of the trainer and the passivity of the learner. This is not conducive to skill acquisition as it deprives the learner of peer feedback, an essential ingredient to sustainability of training and learning in the field, once the trainer returns home and the virtual part of the course begins.

4. Improving humanitarian communication – one interpreter at a time

When training for such a specialized skill one would expect course designers and trainers to provide a highly individualized learning environment that closely matches the needs of the learners. This is all the more important as learners are given little release time for on-line learning, as trainers must operate both within the often serious constraints of conflict zones and in an on-line environment, where every five minutes of connectivity must be negotiated with the organization, or with other NGOs in conflict zones liable to provide computer access to learners: e.g. InZone has worked with the Don Bosco Foundation and Jesuit Refugee Services in Kakuma Refugee Camp to negotiate computer time for interpreters to upload their activities. This was vital to the success of the UNHCR course in Kakuma as 60 interpreters were registered to be trained on-site in the camp, of whom 34 continued on-line. However, due to security considerations interpreters are not allowed access to the organization's computers and InZone then donated two decommissioned laptop computers and bought mobile internet access from a Kenyan service provider for the duration of the course, installed the internet and trained the learners. For our recent course launch with UNAMA in Afghanistan it was necessary to negotiate the release of each page of our VLE by the IT department on-site so that learners could actually work in the VLE. As learners had come from all over Afghanistan to Kabul for the on-site part of the training course, it remained unclear as to whether those returning to the provinces would need to negotiate the release of internet pages upon their arrival in their home town. It is for this reason that we have used responsive design methodology to adapt our learning environment to the use on different mobile devices; the migration has just been completed and should provide a better learning environment to all those having to rely on mobile telephony for learning in the field. However, interpreting being a performance skill and the use and exchange of sound files being an integral part of learning, and mobile telephony in conflict zones being severely restricted for security reasons, responsive design technology does not hold the definitive technology solution for enabling smooth learning in the field.

It is fair to conclude that of the one hundred interpreters from different conflict zones in Kenya, Sudan and Afghanistan who are currently completing the basic course in humanitarian field interpreting, no two present exactly the same technological and pedagogical challenge. We have access to a broad spectrum of technological fixes (Davis and Nyamapfene, 2010) to some of the greatest challenges facing the implementation of learning in conflict zones, and yet, no two conflict zones are exactly alike and ultimately successful learning can happen only through the designers' and trainers' acute attention to detail and constant supervision of both the technological and the pedagogical environment: trainers not only train skills but troubleshoot computer, internet and mobile telephony problems, negotiate internet access with NGOs in the field, and build a local support network prior to leaving the conflict zone.

5. Conclusions

The importance of quality multilingual communication in the field is what has motivated InZone to explore new and unconventional ways of delivering training in conflict zones. As our experience in different zones evolves, a pattern of successful course delivery emerges that requires course designers and trainers to work towards the following standards: 1. Needs vary, even within one and the same organization, and thus require renewed analysis; 2. Learning cultures in conflict zones are largely traditional, and what has become established pedagogical practice in the North and West cannot be immediately implemented in the South and East, but requires constant monitoring and adaptation for sustainability and ownership of learning to evolve; 3. Personal contact with learners in a face-to-face setting is vital to the success of the learning enterprise; although it carries major risks for trainers and learners alike, it is essential to building trust and confidence that are the bedrock of virtual learning; for complex cognitive skills that require regular feedback from trainers and tutors over an extended period of time blended learning is superior to one-off on-site-only learning; 4. There is no one technological solution that fits all learning in conflict zones, and even within one and the same zone personalized solutions must be negotiated, one learner at a time; building a reliable local support network that includes key staff in the organization as well as outside NGOs enables trainers to monitor the situation remotely after leaving the field; 5. Adaptability should be a key characteristic of trainers and tutors working with learners in conflict zones; resilience is essential to working with learners on-site and virtually in conflict zones where a constant flow of information from the field requires trainers to respond in a responsible and confidential manner and in keeping with humanitarian principles. Technology has opened new channels of communication that can transport trainers instantaneously into some of the most dangerous and war-ravaged environments, it has also managed to open the window of education to learners, but care is required to keep these channels open.

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Conflict Resolution and Peace Building in J&K Sate: Need for an Integrated Educational Framework

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"*Literacy unlocks the door to learning throughout life, is essential to development and health, and opens the way for democratic participation and active citizenship*." ~ Kofi Annan

Jammu and Kashmir State is located in extreme North of the country sharing International borders with Pakistan, Afganistan and number of Central Asia countries on the periphery. As such influences of social, cultural and ideological cross currents have for centuries impacted the societal milieu of the state, especially valley of Kashmir from Jhelum basin to the mountain peaks of Pirpanchal. Most of the invasions into Indian peninsula emanated from Central Asian region which in turn not only changed the demographic character of the state but also the socio-cultural edifice. Emerging from the yoke of colonial rule the state embarked on transformational trajectory by providing free education from 1950's onwards. In normal course such a dispensation of free education should have resulted in generational empowerment paving way for socio-economically well-off of masses across the board. However the rise of armed insurgency and cross boarder terrorism beginning from 1990's has demonstrated some fundamental flaws in the prevailing educational framework. However in recent times both the Central and state governments have diversified the portfolio of educational avenues by creating better access and opportunities, especially in the rural and backward areas of the state. The present paper examines various issues which are associated with conflict resolution and peace building in the State of Jammu & Kashmir. The paper therefore starts with the present scenario of education in the State, highlights the factors for its educational backwardness, commitments made by the State to eradicate illiteracy and finally suggests strategic interventions for the promotion of education for peace building on the basis of technology driven integrated approach to create access and equity in spread of education overcoming institutional and spatio- temporal constraints. The biggest challenge today is “that” delivery system of education which enhances employability among the educated youth, otherwise as the recent events in the State suggest that they become vulnerable to such anti State forces which lure them on monetary and ideological considerations. Education must liberate minds from prejudices, dogmas, fundamentalism and help to channelise youth potential in the productive pursuits for individual career opportunities creating quality of life.

In India one in every 10 children in the age group 6-10 is out of school; only around two-thirds of the grade I reach the last grade of the primary cycle; around 84% of primary graduates transit to upper primary level; enrollment and attendance in upper primary level is relatively much lower (GER 71%); and the pubic current expenditure per pupil at the primary and secondary levels (as % of GNP per capita) is 9.0 and 16.7 respectively, it would be interesting to examine the growth trends and development approaches in the early education sub-sector. As greater economic growth and social equity are associated with balanced public educational investment (World Bank, 1993, 2005; Wood and Mayer, 1999), the study of early education reform policies, approaches and programmes in India would not only help identify the development direction but also provide clues for future policy planning.

Jammu & Kashmir is the only state where education is free up to university stage. Yet the state is educationally backward. Against the national literacy rate of 74.04% the state has a literacy figure of 68.74% literacy among male is 78.26%and that of female is 58.01 % (2011 census).The educational backwardness of Jammu & Kashmir State has been since long and can be dated back to pre – independence era. To answer the urgent need of providing better facilities for education, the State Government decided as early as in 1930 to introduce a scheme of compulsory education for boys up to the primary standard. For this a law entitled “The Primary Education Act 3 of 1986 was enacted and was made applicable to few districts though was not implemented. The very low percentage of literacy in the State is a legacy of the past and the cumulative effect of several factors:

i) insufficient number of educational institutions
ii) economic constraints to finance education of children

iii) religious preachings and fundamentalism
iv) learner isolation
v) inadequate infrastructure
vi) low literacy rate
vii) out of school children
viii) lack of monitoring and evaluation
ix) no feedback
x) absence of input output outcomes
xi) technical problems
xii) lack of social interaction

Even today our state has the lowest literacy as compared to major states and Union Territories. In As per 2011 Census, J&K State ranks 30th in literacy among the states of India just above Andhra Pradesh, Jharkhand and Rajasthan. the national educational scenario, J&K is subsumed as educationally backward with reference to the established indices namely, literacy rate, teacher - pupil ratio, drop-out rate and the absorption pattern of the educated persons.

The various schemes launched in J&K State so far are as follows:

1. Operation Blackboard

This Scheme, started in 1987-88, aimed at improving the class room environment by providing infrastructural facilities, additional teachers and teaching- learning material to primary schools. The Scheme was implemented in 197 educational blocks in the State. Under the scheme about 2,450 schools were constructed.

2. Mid-Day Meal Scheme

The National Programme of Nutritional Support to Primary Education, commonly know as the Mid-Day Meal Programme was launched on 15th August, 1995. It aims to give a boost to universalisation of primary education by increasing enrolment, retention and attendance and simultaneously improving the nutritional status of students in primary classes. The Scheme was started with an initial coverage of one lakh children but subsequently all the children from classes I to V were covered under the Scheme. They are provided with cooked and hot meals comprising a minimum of 450 calories and 12 grams of protein content.

3. Sarva Shikha Abhiyan

This special scheme was specially launched in India in 1999-2000 and in State of Jammu & Kashmir in 2003-2004 for universal enrollment, universal retention and quality education. As a consequence efforts were made to realise the ultimate goals of universal education in the State.

4. EDUSAT

India is the only country to launch EDUSAT in 2004 for improving educational facilities for all. In Jammu & Kashmir some selected educational institutions had access to this facility though much could not be achieved through this use.

The proposed model for promoting peace education for conflict resolution in Jammu & Kashmir State calls for experimentation, innovation, diffusion and sharing of information and best practices with policy dialogue in education.

A Framework for Action is proposed focusing the following essentials for Quality education with access and equity :

(1) motivated students;

(2) trained teachers for active teaching learning techniques;

(3) availability and use of adequate facilities and learning materials;

(4) relevant curriculum and text books to match the knowledge and experience of the teachers and learners;

(5) encouraging learning environment ;

(6) accurate assessment of learning outcomes,

(7) good governance and management; and

(8) engagement with local communities and cultures

(9) educational reforms(access, equity & quality)

(10) leadership as agent of change

(11) community involvement and participation

(12) girls education

(13) inclusive education

(14) supporting positive change

(15) strengthening systems

(16) innovation and creation

> "We live in a complex world and the motivation to use violence to solve problems needs to be seriously questioned. It is essential that we help our children perceive peaceful alternatives. We need to use these troubled times as an opportunity to create a new vision for the future."-- Naomi Drew

The following **suggestions** have been put forth for conflict resolution and peace building through an integrated educational framework in Jammu & Kashmir State:

1. The utilization of funds for rural development schemes in the state should be increased. It is also necessary that adequate funds are provided for completion of on-going schemes. Only after the requirement of ongoing schemes is met in full, funds shall be earmarked for new schemes. There is also a need to accelerate the pace of the implementation of programmes.
2. Efforts are needed for the development of infrastructure, generation of employment and alleviation of poverty in rural areas to bring about the desired socio-economic development of Jammu and Kashmir. It is also essential that the schemes proposed under selected sectors in order of priority are completed quickly and become available to the people living in the border villages.
3. A multi-pronged strategy is required to deal with problems of border areas which include willingness to meet and discuss the legitimate grievances of the people, counter violence more effectively, and undertake activities for infrastructure development create employment opportunities, ensure good governance and effective decentralization.
4. The issues regarding problems of displaced people in border areas due to artillery exchanges have to be seriously looked into.
5. There is a need for boosting the NGOs that can play a very important role in supplementing and complimenting efforts of the government in socio-economic development of the people in border areas. NGOs can be involved for socioeconomic development and rehabilitation of the disadvantaged segment of society. A financial

crunch should be no excuse for the disruption of social services being rendered by different NGOs.

6. Development and implementation of self instructional modules on conflict resolution through peace education both formally for children and youth in educational institutions and informally by informal agents of education (family, relatives, neighbours, playground, religious institutions etc) by the State.
7. There is an urgent need to undertake an impact assessment study of the schemes implemented by the government on the socio-economic conditions of the people. Such a study would help in assessing the ground realities about the schemes.
8. A rough guideline about the programme needs to be given to the implementing agencies so that they are aware of appropriate concepts and methods and their proper implementation takes place.
9. To tackle militancy in Jammu and Kashmir, the government has formulated a multi-pronged action plan regarding the activities of security forces and intelligence agencies and related matters as militancy is the biggest hindrance in the education of J&K youth.
10. Networking and appropriate linkages through aid programmes and projects as they have the potential to contribute to turnaround.

J.Krishnamurti, "The responsibility for building a peaceful and enlightened society rests with the educator".

Conflict resolution and peace building through an integrated educational framework provides opportunities to reflect on our underlying beliefs and values and priorities that we choose and act upon. This journey has just begun. It is a journey of self discovery with deep reflection to rethink the purpose of education. The way to peace is a road with many diversions. We need the will and courage to remain committed to the path of education for peace. These attempts may seem small and insignificant but perhaps the most missionary, Mother Teresa (1975) said, "We ourselves feel what we doing is just a drop in the ocean. But the ocean would be less because of that missing drop."

"There is no way to peace, peace is the way", Mahatma Gandhi

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Autonomous Empowerment through Pre-recorded Presentation Software: A Case Study from an EFL Setting at Kanda University of International Studies

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Abstract

More and more meetings and presentations are being shared using webcam communication formats such as Skype and G-chat. Anyone who has ever participated in these kinds of meetings has realized that this format can require a very different communication skill set. How can this format be prepared for and even utilized in and out of the classroom. Using online software students uploaded slideshow presentations to an online program to record themselves presenting alongside their slideshow. The whole process is done online with free software so all the student needs is a computer that has internet access and a webcam and/or microphone. This format was tested in a college EFL anthropology classroom in Japan as a case study, but the possibilities for this process cross over to any subject and level. One of the benefits for students is the autonomous error correction that is allowed through multiple takes of their presentation. Live presentations tend to have a tournament style production, as the student prepares for a one-time take. Even if the student is allowed to do the presentation multiple times in a row they do not get to see their performance. The pre-recorded format allows students to do as many takes as they feel necessary; allowing them to focus on particular points in their presentations. This format also allows time saving and promotes media and computer literacy that students can utilize outside the classroom. The online nature of this tool opens the possibility for peers from distant geographical locations to interact. The pre-recorded presentation research and process as a tool can be used for all facets and levels of education.

1. Introduction/background

> We live in the world of the instant replay. Around the planet, all the events are not only being recorded but replayed. And the amazing thing about the replay is that it offers the means of re-cog, re-cognition. The first time is cognition, the second time is recognition. And the recognition is even deeper. (DrFallon, 2008)

> New media not only introduces new ways for us to express ourselves, but aIso new forms of self-awareness—new ways to reflect on who we are and how we relate to others. (Wesch, 2009)

In the last two decades, the world has experienced a boom of new online interactions, which record and stream anyone who can be videoed. Think for a moment if you can remember the first time you heard of the term video record and replay or more recently video chat, video conferencing or better yet new verbs such as “skyping” or “youtubing”. These words and the concepts they represent are the movement of new mediums of interaction and they continue to grow in variation and exposure. Now Imagine if you can the first time, you saw yourself on video and recognized it was you. Regardless of whether it was on a live stream with a camera connected to a television/computer screen or a recorded video that you were later able to watch repeatedly you witnessed a media that has changed the awareness of self and surroundings. This awareness was theorized by McLuhan (DrFallon, 2008), and experienced by Carpenter (1972) in his interactions with the Sio tribe of Papua New Guinea and further modernized and applied by Wesch (2009) to YouTube. How can these mediums that ignite sparks of self-awareness be utilized for education? In addition, how can education in turn scaffold any new skillsets required for all the mediums that emerge with each new web application?

> Now look carefully at a webcam. That's there. That's somewhere else. That could be anybody. On the other side of that little glass lens is almost everyone you love, everyone you know, everyone you have ever heard of, and even those you have never heard of. In more specific terms, it is everyone who has or will have access to the Internet—billions of potential viewers, and your future self among them. (Wesch, Michael 2009)

In 1994 Connetix released the QuickCam, the first commercial webcam (Edwards, 2010). The Internet had been making great gains in users since the 1980s and the webcam would increase interest. Being able to share live or recorded video online for a low cost has become almost immeasurably popular. It was in 2005 that both YouTube (Hopkins,2006) and Voice over IP's (VoIP) telephony applications such as Skype and G-chat enhanced the access and use worldwide. Both applications use a webcam and the Internet but YouTube is pre-recorded where as VOIP's are most often live.

For the past eight years these platforms have increased in usership and influence on peoples self awareness. Wesch (2009) eloquently compares YouTube webcam vloggers with Carpenter's observations of the Sio peoples reactions upon first seeing themselves in a Polaroid picture. The Sio people after seeing the moment captured in the Polaroid became self-aware as an individual or perhaps the star of the show in a universe in which they could be the center of—at least according to the picture. The webcam if published can be the most public place on earth observed in the most secluded places by individuals or groups familiar or not to the subject. The recordings transcend space and time and can later be watched by the individual in the video as well. As an anthropologist Wesch is interested in the implications of understanding self and community relationships. Not to mention the aspects of self-awareness YouTube fosters as the user stares into the tiny black dot in the center of their webcam recording the most trivial or momentous occasion. Can what Wesch observed in his ethnography of YouTube and the self-awareness it fosters be used to nurture metacognition in students as they become hyper aware of themselves while interacting with the webcam?

Once a video has been recorded it allows for replay to occur. The subject in the video has the ability to watch and re-watch themselves over and over any time after the original recording. McLuhan said replay allowed re-cognition the first viewing would be cognition and the second recognition. McLuhan was considering replay of anything when he originally dubbed the second half of the 20th century the age of replay. Anyone could watch someone or something else repeatedly and as you watch it you become more familiar and experience it more in depth. Wesch (2009) used McLuhan's concept of replay to explain that YouTube vloggers also may have the urge to replay their videos looking back at their former self. How can this self-awareness be channelled into an educational format that encourages metacognition?

2. Webcam education skill set

Seemingly every day a new web application comes out creating a new medium in which we strive to interact successfully or at least coherently in (Wesch 2010). As an EFL/ESL teacher I have spent endless hours thinking of lessons that allow second language (L2) students to pick on and interact with native language (L1) speaker's cues in person, as a competitive speech coach I have worked with competitors on how to pick up on audience cues using appropriate eye contact and body language and as a test preparation specialist I trained students for conversation sections of tests such as the TOEFL and IELS. I remember how shocked I was when I first listened to a student's recorded TOEFL speech on the computer. I was shocked by the discrepancy between the conversations I had had with student in comparison to what I was now listening to. The student had completely fallen apart when speaking to the computer. When Wesch talks about the first time someone sits in front of a webcam a "Context collapse" occurs. Context collapse happens because the individual doesn't know who is going to watch video and also has no live audience to interact with. In all three of the circumstances as an educator I had only prepared the individual for face-to-face live interactions. Though Wesch's context collapse refers to pre-recorded video of vloggers I would argue that the contrast of the two dimensional screen and VoIP's webcam device, even during live communication, takes some adjusting to. When using VoIPs simple things like eye contact is different due to the location of the webcam above or below the screen. Exposure to VoIPs and online video recording is growing and understanding and fluency in interacting with webcams is becoming more familiar. The need for webcam proficiency is growing every year and will most likely become standard practice in business and social settings. The below statistics were gathered by Matt Szymczyk (2011):

- 79% of laptops now have webcams. *(source: PC world)*
- 72% of 18-20 year olds own a laptop. *(source: Pew Internet & American Life Project)*
- 83% of college students own a laptop. *(source: Student Monitor)*
- More than 50% of Gen Y owns a webcam. *(source: Cisco)*
- As of March 2011, more than 40% of Skype minutes involve video to video calls *(source: Skype)*

This increases the need to scaffold (Vygotsky, 1987) student's presentation and communication skills for VoIPs and online video recording. One approach to this is giving providing the students with a controlled setting with a small audience that they are familiar with. One place to start would be creating presentations online for peers to observe and critique. This not only prepares the students for online webcam settings but may also serve as an autonomous learning environment in which the student's webcam induced self-awareness can lead to metacognition.

3. Proposed procedure

In order to scaffold the students into the world of the webcam classes we'll use an online prerecording presentation software called Knovio (Knowledgevision, 2011). Knovio blends the participant's slideshow with a video recording of the participant presenting just as they would do in a live setting (Fig, 1).

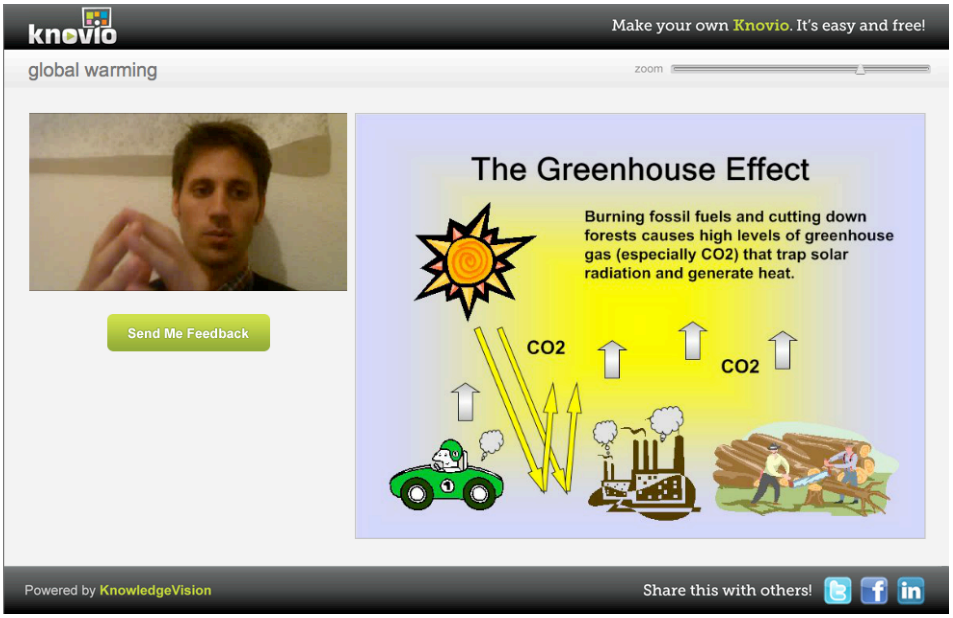

Figure 1. Completed Knovio presentation video

3.1 Uploading a slideshow to Knovio

The student can make the slideshow on Keynote, Microsoft PowerPoint or online with no needed software using Google Docs' presentation tool. After the student finishes the slideshow and makes a free account with Knovio they can then upload the slideshow into the online recording tool (Fig, 2 & 3).

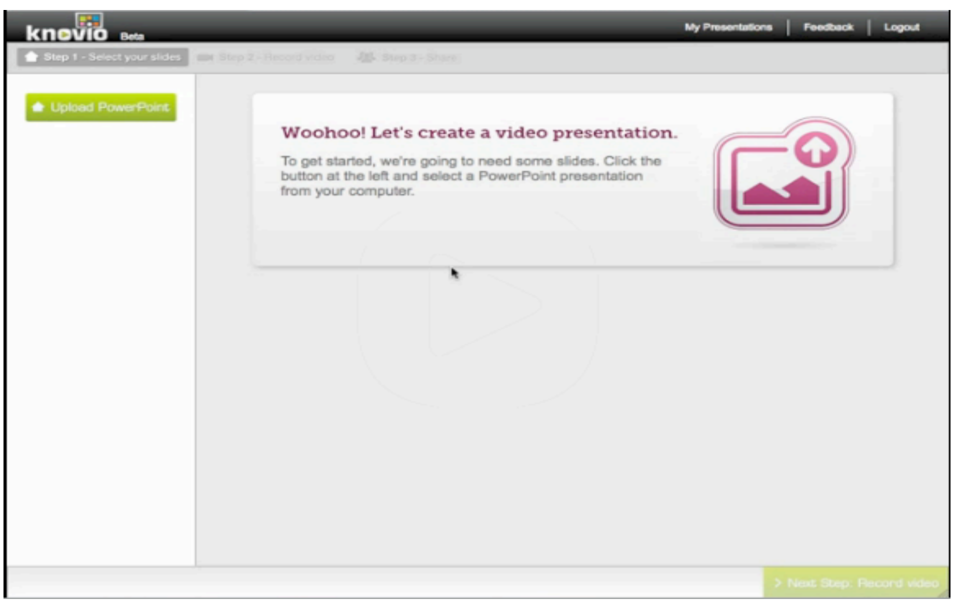

Figure 2. Uploading the slideshow into Knovio

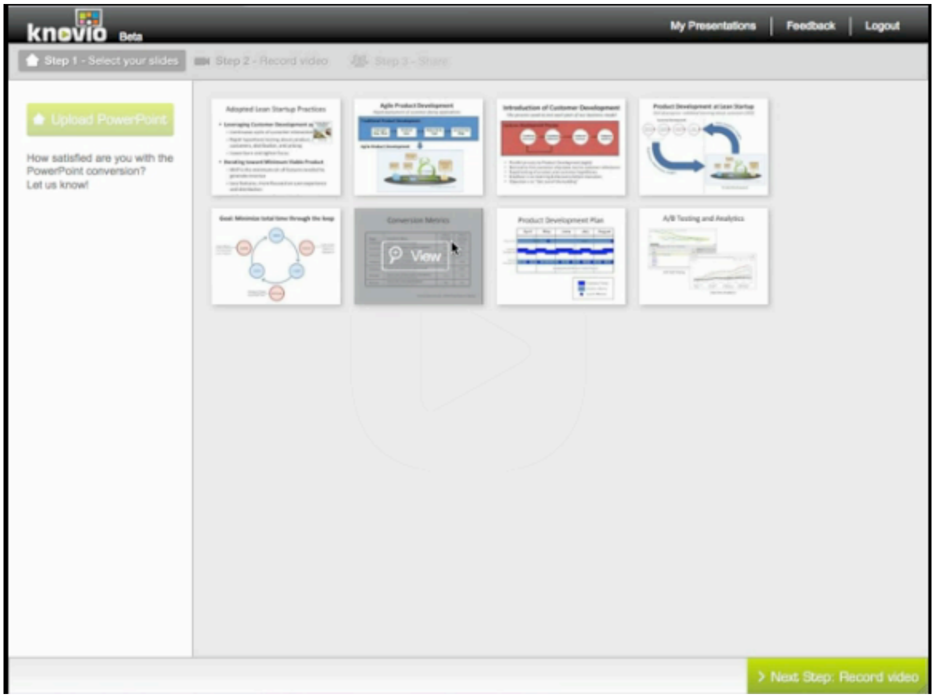

Figure 3. Slideshow uploaded into Knovio

3.2 Adding narration to the slideshow presentation

After the slideshow has been uploaded the student will then continue to record themselves narrating their slideshow while watching it in real time. Please note the narration can be done with a video and audio or just audio alone (Figure 4).

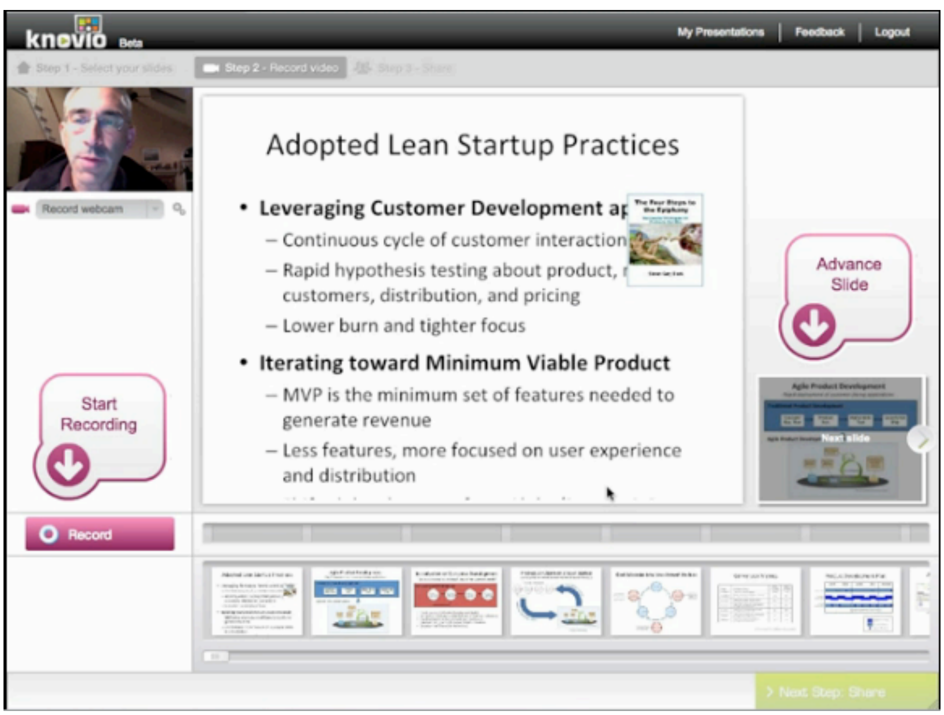

Figure 4. Video being recorded alongside slideshow

3.3 Recording retake explanations

After clicking record the student clicks through the slideshow just as they would in a live presentation (Knowledgevision, 2011). When the student is done recording they will then be able to preview their presentation and if they don't like what they any part of their presentation they can rerecord that slide or the whole presentation if they choose to. One factor to facilitating the metacognitive aspect of these rerecordings is to provide the students with a simple forum in which they can state why they are rerecording and make a plan of action to improve whatever it is they did not like in the current presentation(Fig, 5).

You can do as many or as little retakes of your presentation as you would like.
When you do retakes make a plan for what you will change.
Here is a retake chart. Please write keep a journal for why you did your retakes.

Reason for your retake: (why did you want to rerecord this version of the presentation?)	**What do you plan to change** in the when you record the presentation again?

Figure 5. Retake chart for student reflection.

3.4 Publishing the finished Knovio video

Finally after the student records a presentation that they are satisfied with they can then share it with others in the class through email, embedding, or Knovio's shared spaces(Fig, 6).

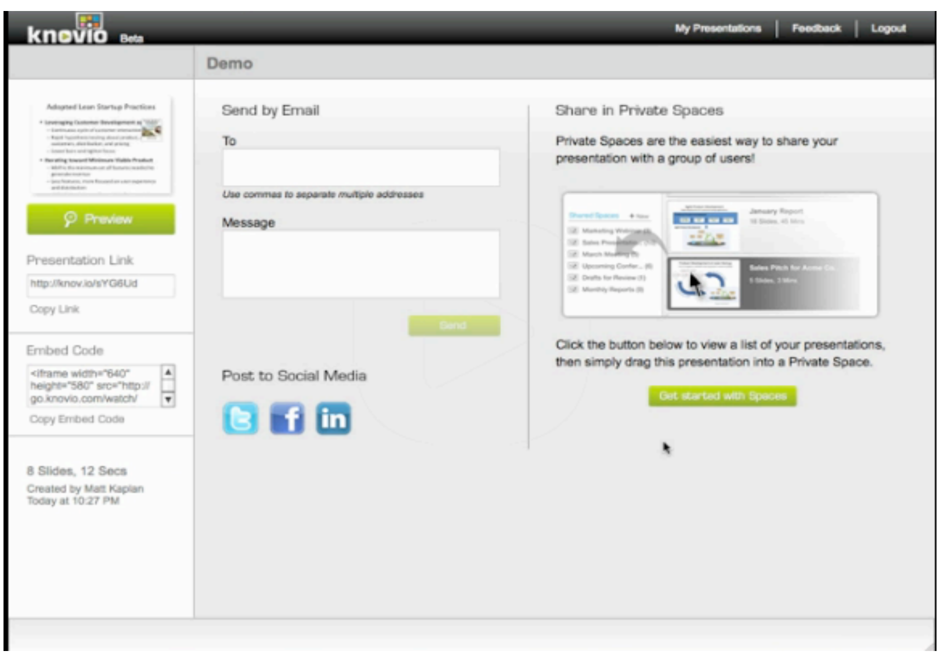

Figure 6. Knovio page too share the finished video.

3.5 Peer feedback on Knovio

After viewing the final presentation peers are able to give feedback in a popup window that appears after the presentation. The individual giving feedback has the option to put their email address with the comment or to leave it anonymous. (Fig. 7)

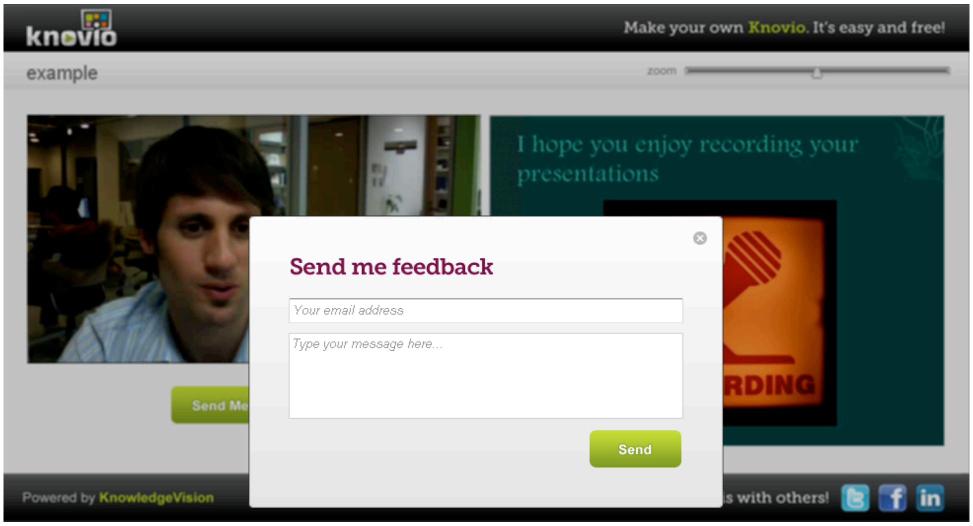

Figure 7. Popup feedback window for Knovio presentations.

3.6 Challenges to the Knovio platform

The technical aspects of Knovio are quite simple but because the program is new as of 2011 so there are still many small issues that may come up when using the program. One of the issues we faced as a class was uploading videos due to firewall issues however this was resolved after contacting the programmers of Knovio. Also in order to have access to the videos as a class we attempted this in two different ways and faced different difficulties with each method. The first was to have only one account as a class. This was a nice system to get the students introduced to the program quickly but if many students tried to record their presentations at the same time the program did not work. To fix this I had the class make their own accounts which worked well for uploading but made it a little difficult to be able to view and share the videos. Even with Knovio's shared spaces the user has to have the email of all who they would like to invite to the space. In short the initial setup can be a challenge but after the program is used once with a class it can then be used outside of class without losing any class time for presentations. Knovio is a free web based program so even with these difficulties it is well worth trying in an educational setting.

4. Pragmatics of Knovio video recording

The most obvious demand to Knovio video recording is that you have to have a video recording device any webcam will work as long as webcam settings are allowed with Knovio. To be published online with Knovio a computer with an internet connection is needed as well. Other than that there is nothing more you need for this platform to work. This Platform could also be emulated by using video cameras and a video library if internet access is difficult. This would however completely change the platform. The videoing and viewing could still be done outside of class and the presence of the camera would still allow for a different set of speaking skills to be nurtured which could lead to a higher sense of comfort with webcams later.

5. Possible positive ramifications of knovio webcam recording

Knovio is not a public space like YouTube and so this will slowly allow the student to emerge into public online spaces. The final recording of the slideshow can be limited only to the class. As a class if the producer of the presentation doesn't know which classmates will view the video they will get a little taste of context collapse, however because the student knows the proposed audience this should be minimal. This will aid in avoiding a context collapse while preparing the students for a more public forum.

The Knovio online webcam recording system allows presentations to be archived and viewed at any time from any computer around the world. The possibilities of sharing presentations with others in a distant education forum are readily accessible.

6. Conclussion

Using online tools to aid in prerecord presentations should in no way replace live presentations for a class but instead be blended in and used as an additional tool and format. If the goal of the class is aimed at presentation and communication skills Knovio should be one of a series of different forms of presentations. However if the class is not focused on these skills this is an excellent platform to save class time as the presentations can be recorded and viewed outside of class.

The online video recording format is definitely needed as more and more interactions demand webcam interaction. The webcam interaction itself opens up students to a context collapse that puts the students in a realm of self-awareness. This realm of self-awareness allows the student to reflect on the skills as a presenter and communicator. With the editing process students can then reflect formally and get a finished product that they have metacognitively edited.

The introduction such prerecording video platforms as a tool for presentations will also continues to benefit students in future study and work. This can either be in the form of preparation or shared presentations for others to view.

7. Further implications

In the initial steps of using Knovio the viewing was only limited to peers within in the class. However due to the online nature of the tool the only thing necessary to share the finished presentations is a computer on the recipients end. Which means classes from other universities even in other countries can share in an academic forum.

The feedback section of Knovio would be an excellent point for further research. Looking at whether anonymity helps with the candidness of peers comments regarding the class presentations. More often than not peers may feel pressured to give a poor presentation positive feedback in order to not hurt the presenter's feelings. The flame wars that happen in the anonymous online forum may be more sincere in the academic setting.

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The MIT LINC 2013 Conference

Parallel Presentations

Session #5

Technology-Enabled Education Applied to Academic Courses: Science, Engineering and Mathematics

- "Project-Oriented Approach with a Matlab/Simulink Environment for Engineering Teaching and Research" presented by Ella Akkerman (Israel)
- "Innovative Teaching and Learning Tools for Foundation in Engineering Education" presented by Christopher M. K. Chew and F. L. Ooi (Malaysia)
- "The Use of Educational Technology in an Engineering School: Then, Now, and the Future" presented by Ray Eaton (Australia)
- "From Flipped to Open Instruction: The Mechanics Online Course" presented by Colin Fredericks, Saif Rayyon, Daniel Seaton and David Pritchard (U.S.)
- "'Sources of Knowledge' For Students Entering A Gateway Science Course" presented by Ahmed Ibrahim (Canada)
- "Active Learning Electronic Resources and Tools for Inquiry on Tablet Devices" presented by Ahmed Ibrahim (Canada)
- "Conceptual Understanding of Undergraduate Students of Calculus in Cooperative Learning Using Calculus Education Software (CES)" presented by Sujata U. Tapare (India)

Project-Oriented Approach with a Matlab/Simulink Environment for Engineering Teaching and Research

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Abstract

One cannot overestimate the role of universities, in the training process of engineering experts that will eventually shape the world's technological and scientific progress.

The past decade has seen many changes in the expectations of students from their studies. For BA students the goal has shifted to obtaining theoretical and practical knowledge in their chosen specialization. For MA students the object is different: some choose to continue their education for a career in research, others opt to elevate their professional competency, teamwork and leadership skills.

Despite different learning expectations, instruction in universities continues to be based on traditional pedagogical methods, such as: "face-to-face" studies, or "E-learning" training and communication, which are overwhelmingly teacher-led.

The purpose of this paper is to search for new methods of education in engineering disciplines that would permit gaining real and practical experience that could be harnessed outside the classroom that would also elevate a graduate's professional competency, as well as his teamwork abilities. This evolves into a more student-centric type of learning.

To this end, we utilize a project-oriented learning approach, in the framework of a classical engineering course, which incorporates our proposed learning module, based on the Matlab/Simulink software environment that can be used for any level of education from BA to Ph.D students alike.

Surveys done annually by our students' association have shown that the usage of our method, correlates with greater learning satisfaction, an increase in self-confidence, and as a general byproduct, a boost in motivation for BA students to continue their studies further.

This method could also help trace talented students and by using "open-

course" technology, we can generate truly global and international education programs.

1. Introduction

In recent years, demands from industrial employers on their professional workers have changed dramatically.
This is readily explained by the fact that today's engineers are graduating with good knowledge in fundamental engineering and computer literacy, but they don't know how to apply this in practice, and don't have strong teamwork and communication skills.
Many publications evidence that students and employers alike, are calling for significant changes in the delivery of engineering education. The critical issues that are reflected in these requests are summarized here [1]:

- Engineering curricula are too focused on engineering science and technical courses, without providing for sufficient integration and relating of, these topics to industrial practices. Programs are too content-driven.
- Current programs do not provide sufficient design experience for students.
- Graduates lack communication skills and teamwork experience.
- Programs do not account for social, environmental, economic, and legal consideration, which form a major component of modern engineering.
- Existing faculty typically lack practical experience, hence they are not able to adequately relate theory to practice or provide design experience.

Therefore, we may conclude that the existing teaching and learning strategies in engineering are outdated. They need to be supplanted with more student-centric ones.
There exist many ways of resolving this problem, from the radical – redesigning the engineering curricula – to the introduction, *ad hoc*, of problem- or project-oriented models in the framework of traditional curricula. Let us briefly analyze these.

1.1 Problem-based learning (PBL) in engineering education

This learning method has been utilized successfully since the 1970s. Generally, this is done through "class-room problems" that consist of completing exercises and assignments, or open-end problems, likewise within a particular course. All commence with the identification of the path to elucidating the given problem, which is itself selected by the course context.

Progress in resolving the problem depends solely on the level of knowledge (of the subject) attained by the student.

Courses containing "open-end" problems, afford students opportunities to choose autonomously the route to the solution.

There are many examples of successful, optimal usage of PBL as a main component of engineering programs of varying levels. However, there are certain limitations to PBL, explained below [2], that discourage recommending PBL as an overall strategy for engineering education:

1. Problems that students encountered during their course cannot always be applied to real-life tasks, which they will certainly counter in their future careers;
2. Much of engineering has a hierarchical knowledge structure. Many topics must be learned in a certain order, because missing essential parts will result in failure to learn later concepts. The problem will be hard for a student to correct, because they probably cannot fully compensate for missed topics, by using only PBL.

It seems therefore that problem-based learning may be a partial answer for resolving the critical issues of engineering education, primarily to demonstrate the applicability of certain concepts in the early stages of an engineering curriculum. However, other active learning, student-centered methods are more appropriate and acceptable for engineering education, and these form the basis of project-oriented learning.

1.2 Project-oriented learning(POL) in engineering

The term "project" is universally used in engineering as a "unit of work".

Almost every task undertaken in professional practice by an engineer will be a project.

Project-oriented learning may be defined alternately by different education disciplines and levels, for instance, it is widespread on the K12 level, which makes it familiar to most students.

The advantageousness of using POL, in comparison with PBL, is listed here [2], and involves the following:

1. Project tasks are closer to professional reality;
2. Project work is directed more **to the application of knowledge**, while PBL is more directed to the acquisition of knowledge;

3. POL is usually accompanied by subject courses (e.g. math, physics, software, &c), whereas PBL is not.
4. Management of time and resources by the students as well as task and role differentiation is very important in POL.
5. Independence of action is greater in project work, than in PBL.

POL may be applied either in particular courses, or through the entire curriculum.

According to Heitmann[3] POL involves the use of small projects within specific courses, which is usually combined with traditional, "face-to-face" methods, within a given course.

POL focuses on application and integration of previously acquired knowledge. The students work in small groups where teachers serve as advisors. The beneficial adaptation of the above approach, in several universities in Europe and Australia, suggests its viability, and allows us to formulate recommendations for continuing progress towards the intended project-oriented curriculum, which revolve around continued training for both staff and students, in the skills needed to make learning effective, such as problem-solving, teamwork, as well as continued education for staff in implementation and assessment methodologies.

An overview of the literature did not evoke any examples of the aforementioned recommendations. Therefore, we find it necessary to offer our own approach, which is based on the development of our learning unit (module) in the context of POL.

2. Our approach

A learning-unit is a building-block of a course. Here, we define a learning-unit as a real-world example, an explanatory feature of a course, designed to test previously gained knowledge. It serves as a real-life project, scaled to the course's topics and form; it also allows a student to expand his teamwork skills.

In order to illustrate our offered method, let us view a specific example:

A group of MS.c and Ph.D students from our environmental engineering department, most of whom have had a hiatus between their current studies and their B.A education. They have been working on a research project, searching for new methods to reduce emissions of pollutants and exhaust fumes from diesel engines. In this setting, apart from the theoretical background, an experimental set-up was formed that had a diesel engine, an electric generator, a spectrometric analyzer, &c.

In accordance with the researched physical process (alluded to above),

Figure.1 Engineers working in a Lab on a project

and based on a mathematical foundation [4], a GUI (Graphical User Interface) in Matlab was formed, as shown in Figure. 2. With the help of this interface, without resorting to actuation or measurements, the students were able to simulate the effects altering input parameters had on the end result (the concentration of exhaust particles).

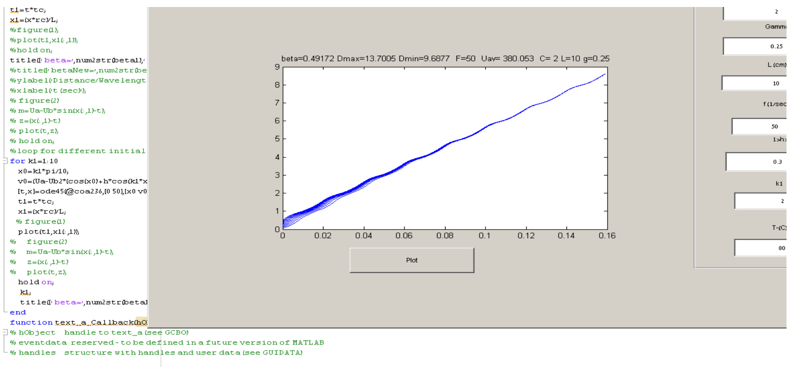

Figure.2 A GUI prepared by Post-degree students

This group of students also serves as TAs (teaching assistants) for entry level students. As a demonstration, let us take the “Control of Air Pollution” course (obligatory for BA students, offered in the same department). Previously, this course had been taught using traditional, face-to-face techniques, with “E-learning” to enhance the course material.
After learning the topic, “Influence of modern vehicles on air pollution”, the students were tasked with constructing a project that would explore this issue in a diesel engine, without any experimental measurements.
The students were informed that the assessment of the project would be based on the implementation of previously mastered knowledge from the “Matlab/Simulink software environment for engineers” course.
For the purposes of their work, they used “SimDriveLine” pack, made available through the “Matlab/Simulink” course mentioned above; we then substituted the drills offered in the course, for such projects.

The students were asked to change input data (speed, power, energy, etc), to experiment with correlating their tweaking with the resultant pollution concentration(presented in Figure 2).

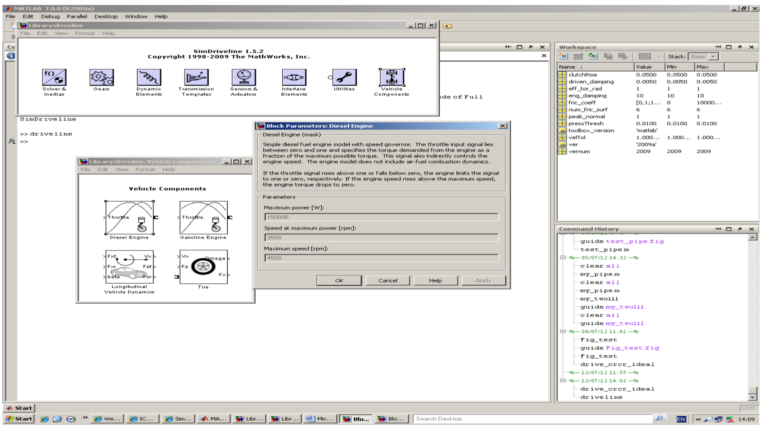

Figure. 3. The dialog box for input parameters

The dialog box for such a procedure is detailed in Fig 3.
In the scope of this work, the BA and post-graduate students work as a team, wherein the latter served as scientific advisors(which elucidate for the students the physical implications of the changes they have made).
As we have observed, the fact that most post-graduates students returned after a pronounced gap to academia, left them without sufficient training in Matlab/Simulinks environments. Thus, the utilization of the same learning unit for students of different levels, allowed:

- BA students to acquire experience in working with a real, live scientific project; the theoretical foundation of which, they received during their regular coursework.
- For post-degree students, to gain skills which they had not had previously.
- And for both, to work as a real engineering team, where the younger members are apprenticed in actual engineering task, and the experienced ones gain valuable training in teamwork and leadership.

4. Results

Let us consider the effect of our method, with the help of the output from an annual survey conducted by our student's association. The students were polled on a series of statements posed to them, and were requested to rate their agreement with the query on a scale of 1 to 5 (5 denoted the highest concurrence, 1 being the least acceptance). The results, shown in Table 1, are tabulated by contrasting two identical questionnaires: one done in 2009 (before the introduction of our method), and in 2012 (after the using our approach).

Table 1. Responses of students to queries, showing data for 2009, and 2012, respectively

	"I find the subject interesting"		"The drill was beneficial"		"I obtained knowledge, skills, and understanding"	
[redacted]	2009	2012	2009	2012	2009	2012
Average score	3.5	4.1	3.0	4.1	3.8	4.4
Percentage of students, awarding the maximum score	23.3%	38.4%	16%	48%	20%	57%
Standard deviation	1.1	1.1	1.3	1.2	0.8	0.9

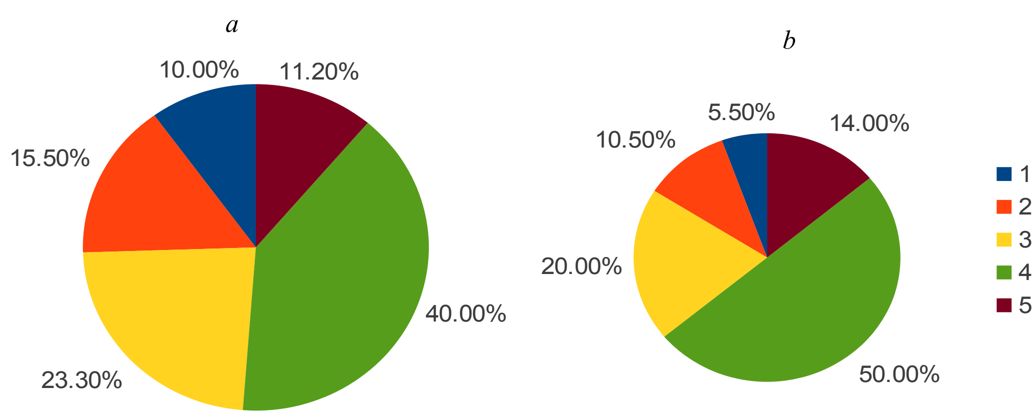

Figure 4. Distribution of students' attitudes to the queries posited

A separate poll was conducted in 2012, for students taught using our methodology. The students were asked to rate two queries, by the degree of their agreement with them, on a scale from 1 to 5, where 1 denotes complete disagreement, and 5 marks full concurrence. We posited two statements: a)*" This method has helped me to learn the course material?",* b)*" I wish more courses be taught using this method"*. The results are depicted in Figure 4 and show that most students are satisfied with our approach.

5. Conclusions

Analysis of the results confirms that using real-world research or practical examples, in the framework of classical engineering courses, that are based on a project-oriented learning approach, may **increase not only learning satisfaction for the students, but also boost motivation in entry level learners to continue their future studies.**
This could be further developed by the usage of “open-course” technology, which allows more effective, easy-changeable , up-today learning programs.

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Innovative Teaching and Learning Tools for Foundation in Engineering Education

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Abstract

Students in Malaysia who aspire to pursue a degree in engineering have the option of enrolling in either a specific foundation programme or a generic pre-university programme, which while offering more flexibility, does not offer the focus of an engineering specific foundation programme. This paper outlines the design of a new foundation programme that is aimed at preparing year 11 students to smoothly transit into an engineering programme of their choice. This programme has three main features, firstly, it is project-based and designed according to the CDIO Framework, secondly, the theory part of the programme is delivered using technology, namely iBook and MOOCs, and thirdly it has and eXtreme Learning Process (XLP). The surveys done to assess the trial runs of the XLP and the iBook indicate that students found the methodology to be both useful and interesting. The first batch of students will join in July 2013 and more data will be available by then.

Introduction

A high demand for a specific-for-engineering foundation programme is present in the Malaysian education sector. Students who are interested to pursue an engineering degree from an early age are keen on taking up an engineering specific foundation level education as opposed to universal pre-university as the appropriate preparation course for an engineering degree. Its foundation programme is the platform to inculcate the essential and necessary skills that are needed for the transition to an engineering degree. In current pre-university courses, there are a lack of emphasis on engineering related skills and knowledge that would serve as the basis to the start of an excellent engineering degree. Hands-on practical work are only limited to laboratory exercises is a common practice for pre-university programmes in Malaysia.

The main research area is the study of the effectiveness and suitability of iBooks, MOOC, XLP and Project-based Learning in conducting Foundation in Engineering classes that would provide a stepping stone with the necessary skills and knowledge towards inculcating an engineering degree. In the Taylor's University Foundation in Engineering course, emphasis would be placed on three main areas namely interactive enhanced learning, hands-on applications and uncovering potential. The Foundation in Engineering would be carried out with the relevant tools to enhance the learning experience as well as develop skills such as team work, communication, leadership and other soft skills which are crucial skills for the development of an engineering student. These areas are done by using four main applications namely Massive Open Online Course (MOOC), iBook, Extreme Learning Process (XLP) and Project-based Learning with the CDIO framework. The use of this application would assist students in completing the Foundation in Engineering programme outcome in a short period of time but with maximum level of achievement.

The effectiveness of project-based learning in higher education has been investigated in the past such as by de los Rios et. al. where investigations into the last two decades worth of project-based learning was conducted in the Technical University of Madrid [1]. There is also similar work that was done in the University of Tokyo where Otake et. al. conducted a study on autonomous collaborative environments for project-based learning [2]. Furthermore, studies were conducted at the National University of Malaysia (UKM) which investigates education for sustainable development utilizing project-based learning methodologies and the inculcation of soft skills through project-based learning [3] [4]. There are also previous studies on the implementation of technological advancements for teaching and learning in higher education in the United Kingdom [5].

This paper reports on the foundation in engineering programme structure and design as well the preliminary findings of the surveys conducted and the future plans.

Methodology

The Foundation in Engineering is a course that is catered specifically as a pre-training to students who are wishing to pursue an engineering degree after their pre-university studies. The course structure and delivery method of the Foundation in Engineering would tackle the discipline specific knowledge of an engineering course as well as the essential skills needed to be an engineer.

The Foundation in Engineering would be delivered by focusing on three main areas namely autonomous learning using technology, hands-on project based learning, and workshops to uncover student potential. These three main areas would prepare students for an engineering degree and would be the essential foundational knowledge that would create a training platform before entering an engineering degree.

The parameters would be tackled using a myriad of delivery methods, autonomous learning using technology would be carried out by the use of education on iPad. Each student in the Foundation in Engineering would be issued an iPad with preloaded iBooks that would replace conventional textbooks for all the subjects in the Foundation in Engineering. Furthermore, subjects offered on the Foundation in Engineering would also be offered on a Massive Open Online Course (MOOC) to provide autonomous learning to students.

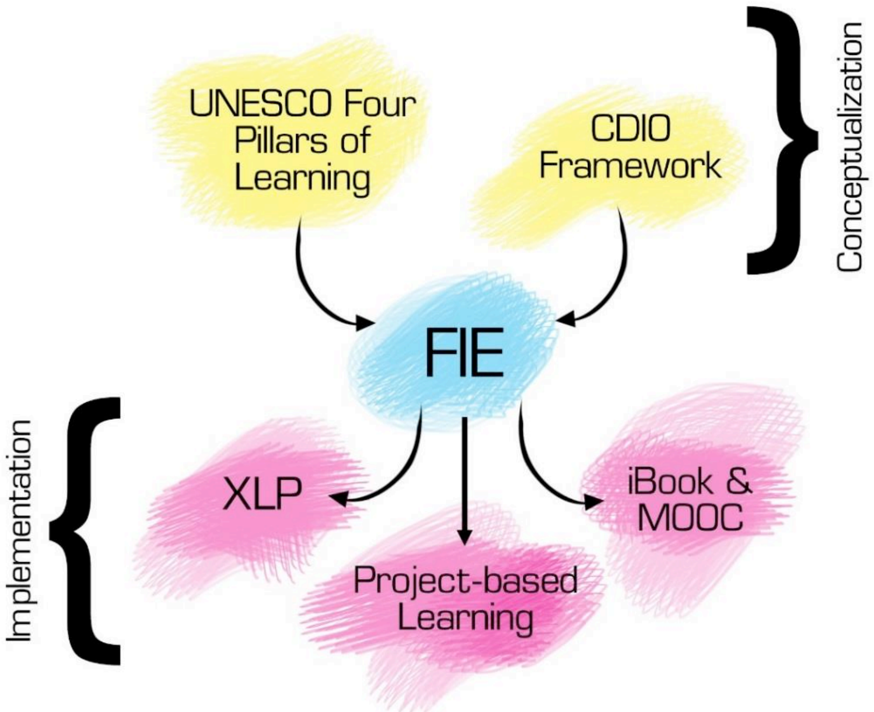

Figure 1: Foundation in Engineering conceptualization and implementation.

Figure 1 depicts the conceptualization and implementation of the Foundation in Engineering programme which is designed using the UNESCO Four Pillars of Learning and the CDIO Framework and implemented using tools such as XLP, Project-based learning, iBooks and MOOC. The UNESCO Four Pillars of Learning places emphasis on a holistic approach towards education, and the CDIO Framework would form the basis for cultivating systematic engineering problem-solving skills. The programme outcomes for Taylor's University's Foundation in Engineering programme are developed based on the goals set out by UNESCO and CDIO [6].

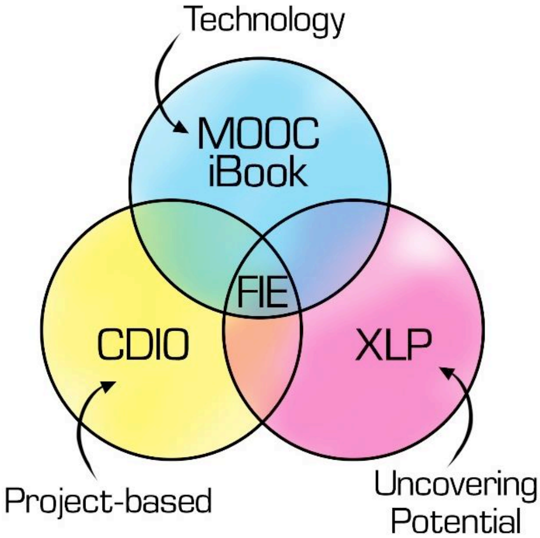

Figure 2: The main parameters encompassing the Foundation in Engineering delivery methodology

Education on iBook & Massive Open Online Course (MOOC)
The iBook is an interactive platform for the teaching and learning of the Foundation in Engineering. It has the capabilities of replacing physical textbooks and also enhancing them with superior functions that surpass those of regular eBooks and pdf files which are merely digitalized versions of the original book. The iBook would be a useful tool for the education sector as it has the capabilities of making the process of learning interactive and interesting. Among the functions and capabilities of an iBook that would be integrated into the Foundation in Engineering include:

- Improved graphics and visualizations to express various ideas. Users can touch and expand diagrams, pictures and text for better understanding.
- 3D-diagrams that can enhance the visualization of various engineering drawings and systems.
- Embedded educational videos that does not require streaming and can be accessed without an internet connection.
- Tutorials, questions and problems posed in the iBook with immediate answer checking capabilities.
- Ability to conduct search for meaning, definitions, or additional information by highlighting words in the iBook.
- Embedment of any functioning webpage into the iBook to enable users to access various applications such as social media, discussion threads, forums and groups to improve lecturer-student interactivity.

- Note taking and highlighting that can be converted immediately into study cards to assist revision sessions.
- All textbooks located in one place with the relevant notes without having the necessity of physical books.
- Ability to continuously update the iBook throughout the course of teaching and learning through feedback and suggestions from various users.

The iBook can be a tool of teaching and learning that is used and synchronized between various institutions across the globe. Updates and changes can be made by various parties with Apple's iBook Author software and sharing is easy and convenient. Authors may consists of educators and students alike with contribution from both parties to make the teaching and learning process fun, informative and engaging. As no actual publication is required, amendments can be made without the need of reprinting the entire book. All users can receive new updates easily without making any new purchases.

The Foundation in Engineering is targeted to expand into a MOOC platform whereby the various modules in the Programme would be offered to students from all over the world, free of charge, through an open online environment. The objective for the Foundation in Engineering Programme is to prepare students for the world and university life by using the latest technologies and innovations to aid students' learning process. The expansion into MOOC would break the geographical and financial barriers and allow this course to be accessible from all around the world. Furthermore with all the materials for the Foundation in Engineering being developed using latest technologies and embracing innovation, conducting the Foundation in Engineering online would be a natural progression. The development of the Programme textbooks entirely on the iBook platform would make it portable through the digital world.

In addition, having an open source education platform would see input from students and academicians from all around the world and allow the programme to progressively improve over time. The Foundation in Engineering would be the first foundation programme in Malaysia to be offered online for free. As a developing nation, Malaysia is still facing issues where citizens in various states of Malaysia have limited or no access to tertiary education. By having the Foundation in Engineering offered as an MOOC, steps are taken to hopefully affect a change in the current state of education in Malaysia. With better education comes improved living conditions and a better future for the nation.

Table 1: Implementation plan for iBook.

Proposed iBook Strategy and Its Objective(s)
• Autonomous learning capitalizing on the latest technology • Improve interactivity between lecturer-student and student-student • Enhance interest of learning in students
Planning Assumptions and Decisions
Students taking the Foundation in Engineering course would be supplied with and iPad preloaded with subject iBook for respective subjects. It is assumed that students are technology savvy and would be able to use the iPad and relevant applications without hassle.
Ownership/Stakeholders
Lecturers and tutors of respective subjects would develop the iBook and produce relevant materials for the students. Authors and Taylor's University would claim ownership on the iBooks used.
Work Breakdown Structure
In order to ensure the classes for Foundation in Engineering are conducted smoothly, the following tasks are to be completed: • Update individual subject syllabus to reflect newest information and knowledge

• Ensure all written materials are incorporated into the iBook • Staff and developers to be supplied necessary resources such as iPad and other related items in order to develop materials
Timeline
Phase 1 to complete two iBooks for the subject of PHY3015 Physics 1 and ENG3014 Engineering Innovation, Civilization and the Future of Humankind by July 2013. Phase 2 to complete a further two iBooks for the subject of PHY3025 Physics 2 and ENG3024 Engineering Design and Innovation by December 2013.
Cost and Resources Required
Each faculty member of the Foundation in Engineering Programme to be supplied with an iPad and necessary tools amounting to approximately RM 20 000.00. Additionally, each enrolling student would be supplied with an iPad costing RM 1 500.00 each.
Means of Monitoring and Control
A student feedback would be conducted after each chapter of the iBook for each subject to gain student input and comments.
Impact Assessment
Student academic performance would be key indicator. Additionally, survey would be conducted at the end of the semester to gain insightful assessment on the successful usage of the iBook.

Project Based Learning and CDIO

The Foundation in Engineering is the first and only programme at the foundation level to be constructed using the CDIO framework. Hence there will be heavy emphasis on project-based learning in the subjects that is conducted through the Conceive, Design, Implement and Operate mindset. With students being exposed to hands-on project work at a foundation level, students would be well prepared to make the transition to a degree level without significant culture shock. Project-based learning would be carried out each of the two semesters in the Foundation in Engineering with students having to complete a project in one of the modules offered in each semester.

With a dedicated module to teaching Engineering Design, the foundation students would be able to learn and apply CDIO before any other Engineering students. This guided and assessed project-based learning would be the platform for students to work in teams and think innovatively. Projects completed in the semester would be presented at an Engineering Fair, Hackerspace or a similar event to have industrial experts, academicians and the public assess and comment on the projects. This sharing of knowledge and guidance from external sources would serve as a guideline and benchmark in creating and producing projects of commercialization quality. Furthermore, the input from various parties would assist students in improving themselves at an early level. This would also serve as an experience pot for students to gain valuable insights into the needs and demands of the society.

Two project-centered subjects would be taught to students in two semesters. These subjects are:

- ENG 3014 Engineering Innovation, Civilization and the Future of Humankind
- ENG 3024 Engineering Design and Innovation

The two subjects would take on a CDIO approach in the learning process, in which students would have to work in groups to solve engineering challenges in the form of a project or product. Students would be assessed on their project work and be given an opportunity to present and justify their case to members of the public comprising mainly of industrial experts and academicians. This project-based learning approach is designed to train the students in critical thinking, decision making techniques, leadership, teamwork and communication. The skills would be essential in progressing forward with an engineering degree.

Table 2: Implementation plan for Project Based Learning

Proposed Project Based Learning Strategy and Its Objective(s)
• Provide practical hands-on application knowledge and experience to students. • Expose students to working in teams on solving challenges • Allow students freedom for creativity, expression and management
Planning Assumptions and Decisions
Students taking the Foundation in Engineering course would be taking an engineering design module in each respective semester, ENG3014 Engineering Innovation, Civilization and the Future of Humankind in semester 1 and ENG3024 Engineering Design and Innovation in semester 2. A project addressing an engineering challenge would have to be completed in the 18 weeks of a semester.
Ownership/Stakeholders
Module coordinators would propose project titles for teams of students. Students would have ownership towards their own projects.
Work Breakdown Structure
In order to ensure the classes for Foundation in Engineering are conducted smoothly, the following tasks are to be completed: • Project planning to be conducted by module coordinator, prior to the start of the semester • Resources and materials need to be ready for student use • Project supervisors consisting of individuals who are motivated are to be assigned to randomly drawn teams of students • A clear objective and goal of the project has to be outlined • Assessment methods and breakdowns to be ready at the start of the module
Timeline
Students would have 18 weeks to conceive, design, implement and operate an engineering product. Students would need to have a presentation and demonstration at the end of the 18 weeks.
Cost and Resources Required
Cost and materials required for the construction of the project would vary according to project assignment.
Means of Monitoring and Control
A faculty member would be assigned to each team as a project supervisor, to check weekly meeting logs, project proposal, and project report. Project supervisors would also provide advice and guidance to the teams of students.
Impact Assessment
Students would be evaluated at the end of the semester by the module coordinator and appropriate marks would be awarded. Additionally, external parties would be invited as part of the evaluation team, comprising of engineering industrial personnel and academicians, to provide feedback and rate the performance of the students.

Extreme Learning Process (XLP)

The Extreme Learning Process (XLP) is an intensive 4-days educational workshop that is conducted to allow participants to gain extensive knowledge of a particular system or topic of study. The XLP would be used as an educational tool to conduct and teach the Foundation in Engineering. XLP is conducted on the pretense of an intensive 96-hours continuous learning process with participants receiving minimal break time. Furthermore, participants would be *quarantined*, and cut off from any distractions or disturbances to ensure a completely focused environment to be able to absorb vast amounts of knowledge in a short period of time. The XLP is conducted based on a scenario of a project that participants would have to conceive, design, implement and operate within the 4-days. Due to the intensive nature of the program, all participants are required to declare if they have any health issues or are under medication.

In addition, periodical testing for blood glucose level, hand-eye coordination and speech are carried out to ensure that participants are still mentally and physically capable of carrying out the entire XLP.

XLP is a platform for education that can be conducted across institutions without boundaries. Taylor's University Malaysia conducted a joint XLP session with Tsing Hua University, Beijing to a very successful outcome. The main objective of that particular XLP session that was conducted was to introduce programming and robotics to students while enhancing the participants' presentation and business skills. The scenario in the aforementioned session was an oil and gas company seeking to use robotics to discover and recover natural gasses underneath the ocean bed, off the coast of a fictional island.

Over the course of the XLP, participants were given problems and challenges that were commonly faced in real life situations and were forced into thinking and coming up with an immediate solution. Furthermore, discussion sessions were conducted with the participants from Tsing Hua University to share knowledge and findings from the course of the session. At the end of the 4-day session, participants are required to produce a complete lab scale robot with a simulated environment and a business plan to convince venture capitalists to invest.

The process was well received by the participants who had zero knowledge in the field that was pursued. The intensive course has exposed the participants to the relevant areas with a majority finding the session to be beneficial in future endeavors. This favorable response from the participants indicates a potential in using the XLP as a tool for education by utilizing it as a medium for instruction in various subjects. Among the benefits of the XLP workshop include:

- Ability to shorten the learning period from an average of 4 weeks to 4 days without compromising the learning outcomes of a topic.
- Enhanced concentration and the ability to focus from participants with no distractions and disturbances.
- Improve teamwork and communication skills between participants as strict and short deadlines forces them to work together.
- Improve time management skills and prioritizing by participants in order to achieve deadlines on a short notice.
- Communication and collaboration between participants of a foreign country improve the understanding of different learning cultures and requires participants to overcome communication barriers.

Table 3: Implementation plan for Extreme Learning Process (XLP)

Proposed Extreme Learning Process (XLP) Strategy and Its Objective(s)
• Achievement of Foundation in Engineering programme outcomes in a short period of time • Enhance students communication and teamworking skills • Uncover student potential as leaders • Instil a systematic problem solving approach in time constraint challenges
Planning Assumptions and Decisions
Each subject in the Foundation in Engineering is targeted to have one session of XLP per semester in the respective area of learning. The XLP would help enhance students' knowledge in a particular topic and serves as a platform for students to excel in soft skills.
Ownership/Stakeholders
Lecturers and tutors of respective subjects would plan and organize each individual XLP. Student would complete a project in the short workshop period and ownership of the project would belong to both lecturer and student.
Work Breakdown Structure
In order to ensure the classes for Foundation in Engineering are conducted smoothly, the following tasks are to be completed:

• Timeline for XLP to be scattered across the 18 weeks from subject to subject • Planning of XLP to be done prior to the start of the semester • Topics that are complex are to be identified as topics to be addressed in the XLP
Timeline
Each XLP session is expected to be run for 4 days. With 4 subjects, the XLP should be run at a 4 week interval from each XLP.
Cost and Resources Required
Each XLP would have varied cost and expenses depending on the project and topic addressed. An estimate expenditure of RM 1 500.00 to RM 4 000.00 per XLP is expected.
Means of Monitoring and Control
Facilitators and lecturers to be present throughout the XLP to monitor students' progress and provide necessary feedback and guidance. Students are required to give a presentation on progress update at the end of each day.
Impact Assessment
Student would be assessed at the end of the XLP and appropriate marks to be awarded. A pre- and post- survey would be conducted to gain insight into the progress of the student.

Results

A sample of nineteen participating students in the Extreme Learning Process (XLP) was interviewed in a written survey before and after the XLP in relevant areas. The participants were required to rate from a scale of 1 to 5 in the various parameters their personal evaluation of themselves. 1 would be the lowest and 5 would be the highest competency. Participants were assessed one hour before the XLP and one hour after the XLP with a four day duration of the XLP as an interval. The results were computed by comparing the before and after personal evaluation of each participant to determine an improvement, decline or equivalent in their personal skills.

Table 4: A comparison of the level of knowledge gained before and after the XLP

Parameter	Improvement		Equivalent		Decrease	
	No. of Students	Percent (%)	No. of Students	Percent (%)	No. of Students	Percent (%)
Knowledge in Mathematics and Science	9	47.4	10	52.6	0	0.0
Problem solving skills	13	68.4	6	31.6	0	0.0
Ability to discover new knowledge	11	57.9	8	42.1	0	0.0
Holistic thinking capabilities	12	63.2	7	36.8	0	0.0
Decision making capabilities	11	57.9	8	42.1	0	0.0
Leadership skills	11	57.9	7	36.8	1	5.3
Awareness of social responsibility of engineers	9	50.0	9	50.0	0	0.0
Teamwork skills	11	57.9	8	42.1	0	0.0
Writing and oral communication skills	11	57.9	8	42.1	0	0.0
Presentation skills	12	63.2	6	31.5	1	5.3
Global understanding and perspective	12	63.2	6	31.5	1	5.3
Ability to set goals and achieve them	15	78.9	4	21.1	0	0.0
Ability to manage projects and achieve objectives on time and within budget	15	78.9	4	21.1	0	0.0

From Table 4, it can be observed that each parameter has seen an average of 60% improvement by the participants. This is a significant improvement on a participants skills in a mere four day session. The development of each skill in a short period of time has shown the effectiveness of the XLP in developing student's potential.

Table 5: Foundation in Engineering Programme Outcomes

PO 1	Appreciate the role engineering, innovation and technology play in developing and sustaining human civilization.
PO 2	Exhibit thinking skills and triumphing over challenges abilities.
PO 3	Communicate effectively.
PO 4	Effectively search for information from different sources including online sources and reference them properly.
PO 5	Apply team strategies and contribute positively to team objectives.
PO 6	Use science and mathematics to describe real world phenomena.
PO 7	Analyze various challenges using the Scientific Method.
PO 8	Conceive, Design, Implement and Operate simple engineering systems and products.

With the use of the XLP, it is clearly observed that the use of the XLP would be a tool for the students to achieve the Programme Outcomes. Programme Outcome 2, 3, 5, 6, and 8 can be achieved by using the XLP in a short period of time. Student's learning experience and achievement would be enhanced by using the XLP as an educational teaching tool.

A survey was conducted on 24 random students and academicians on the comparison between iBook and PowerPoint. Participants of the survey were shown a PowerPoint slide of a topic in a Foundation in Science Physics class that is currently being used by lecturers. The same content was converted to iBook format and shown to the participants. An evaluation of various comparative parameters of the two materials were done by the participants.

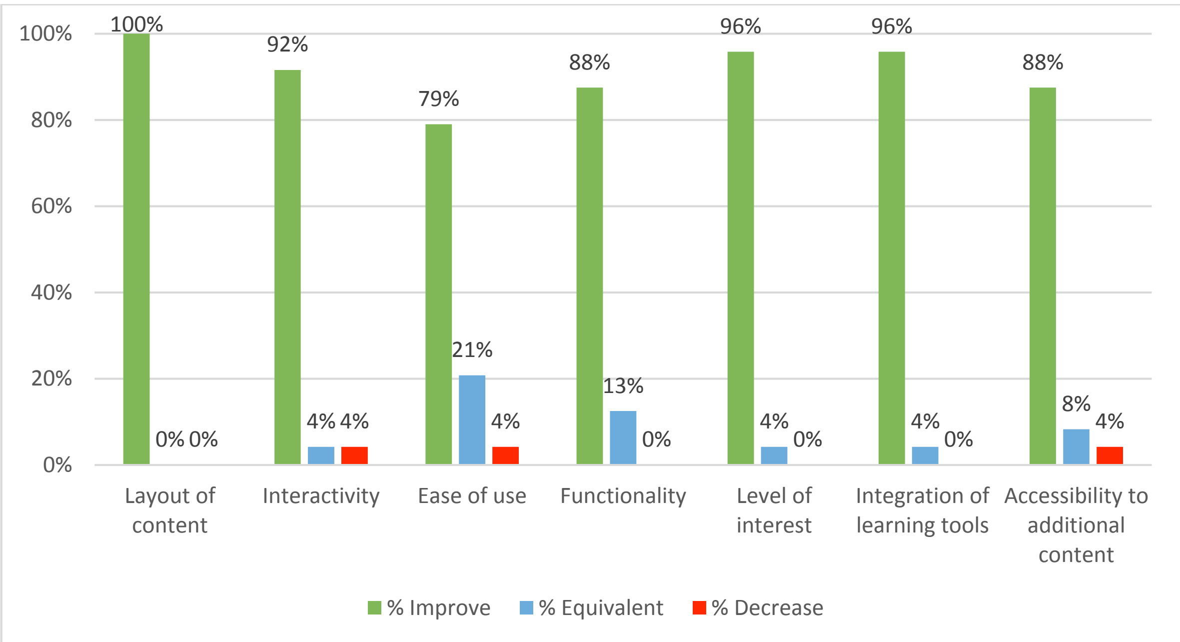

Figure 3: A comparison between various parameters of the iBook versus PowerPoint

From Figure 3, it can be observed that an overwhelming number of participants have responded positively towards the teaching material in the form of the iBook as opposed to the PowerPoint format. The favorable results are an indication that the iBook is a format that would be well received in terms of approach and functionality. An additional question of "would the iBook improve the overall student learning experience" received a "yes" from 23 of the 24 respondents. Additional elaboration by the participants showed that the iBook is well received due to its interactive content, portability and functionality.

Table 6: Teaching tools and programme outcome achievement mapping

Programme Outcomes	iBook	XLP	PrBL
1	X		X
2	X	X	X
3		X	
4	X		X
5		X	X
6	X		X
7	X		X
8		X	X

Referring to Table 6, it can be inferred that these tools are essential in the achievement of the Programme Outcomes of the Foundation in Engineering Programme.

Conclusion

The various tools described in this paper would achieve the Foundation in Engineering Programme Outcomes that prepares students for an Engineering degree. Prospective engineering students would find the transition from foundation studies to tertiary education less jarring through the implementation of the discussed tools in the Foundation in Engineering programme.

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The Use of Educational Technology in an Engineering School: Then, Now, and the Future

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Abstract

This paper provides an overview of the use of educationally technology within the School of EE&T at UNSW in the last decade, and highlights the evolving use of such technology both now, and into the future. Since 2001, the School has made use of an innovative Virtual Classroom developed and built in-house, to deliver teaching material, both in on-line blended courses as well as support material for traditionally run courses. In addition, to support the laboratory environment, the School has also implemented Distributed Teaching Laboratory Facilities, allowing multiple laboratory classrooms to be "connected" during any lab session. Both the virtual classroom and Distributed Labs consist of interactive electronic whiteboards, video cameras and audio to transmit and capture the lecturer and/or students, and dedicated software to integrate all media streams to a computer. Moving forward, with the proliferation of iPads and other small tablet technology amongst our students, it is apparent that Engineering education, and education in general, can take advantage of, and benefit from, the flexibility of this new technology as well as the significant investment in its future. We describe how iPads and tablet devices are starting to be used in this School and our collaboration with Taylor's University College, Malaysia.

1. Introduction

There are common challenges across higher education environments, such as maintaining students' attention, and in a science or engineering context, communicating difficult mathematical concepts. In a multicultural society such as that experienced in Australian universities, there is the additional obstacle for students of lack of fluency in spoken and/or written English. Today there seems to also be societal demands for students to be involved in more extra-curricular activities of commitments, in particular part-time work due to a desire or need to support their studies. These demands can and do impact on students' study habits, including their attendance at live lectures [1].

As a result, only a small percentage of students are able to grasp the key concepts that are taught in the live lecture, and a large number of students are left to develop the critical understanding in their own time with whatever assistance they can find outside of the lecture. Their additional commitments often results in them being fatigued and their concentration span in the lecture is low or they lose continuity due to missed classes.

Due to these factors, amongst others, the School of Electrical Engineering and Telecommunications (EE&T) at the University of New South Wales (UNSW) has embarked on the introduction of innovative educational technology to support students learning. This has been a process which started over a decade ago, but has been accelerated and consistent since around 2005. Chiefly amongst this technology, a virtual classroom facility was developed to provide students the ability to review lecture material in their own time, also encouraging self-directed study [2]. The virtual classroom allows for the video recording of lecture or tutorial material incorporating real-time annotation on the interactive electronic whiteboard. This facility has been used increasingly since its first introduction, and many lectures have now been recorded this way. In particular, since 2009, the School has successfully run a suite of summer courses which rely on such lecture recordings [3].

Currently of course, and since the implementation at UNSW, we have seen a steady increase in the use of such or similar technology. Kay et. al [4] provides a comprehensive literature review on the use of video podcasts to delivery teaching material, also highlighting the perceived advantages and challenges as reported by the various articles referenced therein. In more recent works [5-8], the authors provide analysis on the various characteristics or elements of using video recordings of lectures. The word “virtual” in virtual classroom tends to imply real-time online implementation in many works. In [5], virtual classroom refers to the recording of live lectures in real-time, where a comparison is made in using the virtual classroom in both online and blended mode. A common theme in many analyses is the level of student interaction and synchronization (real-time or not), [5-6]. In [7], the authors studied the dependence of learning effectiveness on “social presence” – interestingly, it was claimed the study seemed to indicate that the presence of the instructor in the video lectures was more a disadvantage. Finally, in [8], the authors undertook a study of the use of video lectures for large undergraduate classes, finding amongst other things, that the recorded lectures were of more benefit for the lower achieving students than the higher achieving students.

With an extensive laboratory component in the School’s undergraduate programs, student’s learning is also strongly influenced by the lab classes and facilities. Generally, there has been increased interest in technology, particularly online technology, to improve the laboratory experience as well as improve access to labs. In particular, there is significant interest in, and implementation of, virtual and remote laboratories [9-10]. These works describe implementations of remote and/or virtual laboratories, essentially answering a problem or resource availability, such as equipment and space. To assist in traditionally run labs, [11] describes the use of video tutorials and instruction, helping students with concepts as well as the use of equipment.

A Distributed Teaching Laboratory was introduced in 2010 to enable “connected” lab classrooms, connected in the sense that laboratory teaching and demonstration can take place in one lab and be accessible in other labs. This feature also enables interactivity amongst students in all classrooms and is possible via the use of interactive electronic whiteboards and video equipment. This technology is useful for larger student groups who cannot fit into one lab room, and is particularly practical in our final year design course, where all students (80-120 students) undertake the same designs at the same time during the week, and are instructed across multiple laboratories.

The following sections will detail the use of the above mentioned technology in the School of EE&T, and also discuss the School's future use of educational technology. More specifically, and considering the proliferation of the use of iPad and tablet devices, the School wishes to embark on a program of improving teaching and student learning via the use of such technology.

2. A Brief History of Educational Technology in the School

The challenge of communicating difficult engineering concepts in higher education environments is not uncommon. This challenge can be greater depending on the environment within the institution/school. There are several factors which contribute to this challenge:

- Difficult engineering concepts are often mathematical in their foundation, and communicating difficult mathematical concepts in turn can be challenging;
- Students will learn at differing pace, although this could be said for all disciplines;
- The University of New South Wales and Australian universities in general, are significantly multicultural, resulting in many students not having English as their first language. There are approximately 26% international students across all Faculties, and this number is higher within Engineering.
- Due to a change in societal demands, a significant number of students work in paid part-time employment, either through desire or necessity. Data collected several years ago between 2003-2006 from students within the School of EE&T, suggested that at that time, an average of approximately 45% of students were in paid part-time work, with the trend increasing.

The factors mentioned above were resulting in a significant proportion of students not being able to clearly understand the concepts being presented in live lectures. Understanding the critical concepts outside of university contact time requires students availing themselves of any assistance necessary and is more difficult due to an apparent increase in extra-curricular activities. Such a situation also leads to a vicious cycle, where students are fatigued in further lectures, adding to their difficulties.

The rule-of-thumb adopted at UNSW with regard to study is that for every live contact hour at university (lectures, tutorials, and labs) students should spend another hour outside of class studying. For many engineering courses, there are approximately 22 timetabled class hours on average, resulting in a demanding study expectation away from class. Data, unpublished thus far, and gathered from 2003-2008, suggests that 75% of students were spending less than 10 hours of study per week outside of class, and that 36% were studying less than 5 hours per week outside of class.

Within the School of EE&T, and as recognised by the second author, traditional lecture delivery modes including blackboards (chalk and talk) and projection transparencies were not as effective as required. Even the currently more common PowerPoint presentation was not the answer to address the issues above. An alternative delivery mode was needed – a mode of delivery that would encourage self-directed study by students and assist them in garnering the required understanding of engineering concepts. It was felt vital that students gained immediate clarification on important concepts if they encountered problems when they learned new material.

2.1 The Virtual Classroom and DVD-based Lectures

In light of the factors affecting the learning environment, a new additional method of lecture delivery was developed in 2005 by Eliathamby Ambikairajah. This method was intended to promote self-directed learning and to address the various challenges and ever more apparent issues of the traditional classroom lectures. The method involved utilising the virtual classroom facility to capture all lecture material.

The virtual classroom allows for the video recording of lecture or tutorial material incorporating real-time annotation on an interactive electronic whiteboard. In particular, the captured and distributed material includes synchronised electronic whiteboard content, the lecturer's handwriting annotations on the board and video of lecturer, as shown in Figure 1. Initially all material was written to DVDs and supplied to all students.

These lectures captured using the virtual classroom can be done in a flexible way, with or without students in the room. In particular, the lecturer may choose to develop smaller 10-15 minute electronic whiteboard-based lectures, giving more detailed step-by-step explanations for more difficult concepts, otherwise not possible in a traditional face-to-face lecture. Although not used for this purpose initially, this technology is also ideal for recording annotated solutions to selected tutorial problems, which can be uploaded for student access as an additional support mechanism.

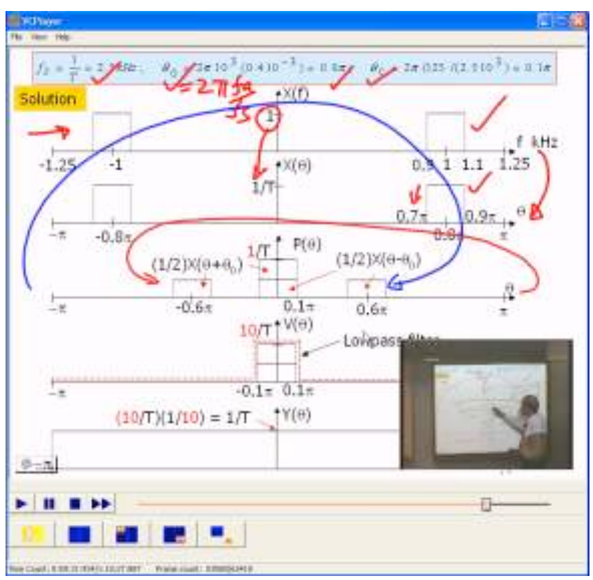

Figure 1: Screen capture of interactive electronic whiteboard lecture

The recorded lecture material provided students with the opportunity and flexibility to review whole lectures or parts of lectures which they are having difficulty with, at a time of their choosing. The lectures captured in this way were not meant to replace live face-to-face lectures, but provide an additional support resource. However, in the event that students did miss a face-to-face lecture, the captured content provided students the opportunity to view and review the lecture material that they missed.

The School of EE&T has now compiled many lectures using the virtual classroom facility, such that there is an apparent evolution in the method of delivery of material to our students, as seen in Figure 2. The new methodology has been used to great effect in several courses including summer semester courses run in a blended and block-mode format. Progressive student feedback on the use of the electronic whiteboard-based video lectures and tutorials has been very positive, with the overwhelming majority of students highly commending the use of the lectures recorded in the virtual classroom, and expressing the view that they appreciate the support and flexibility gained. The technology should be more widely adopted in all appropriate Engineering courses.

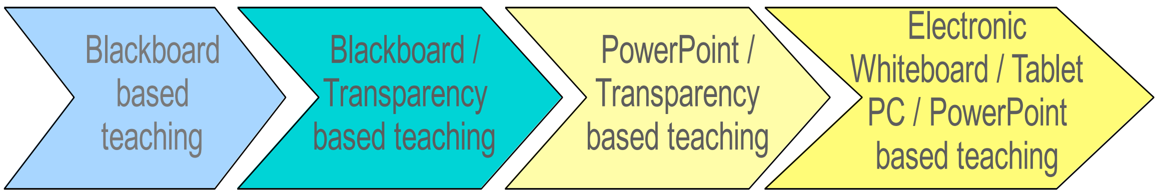

Figure 2: Evolution of lecture delivery method

2.2 The Distributed Teaching Laboratory Facility

An important part of Electrical Engineering education has always been the existence of laboratory-based education, exposing students to the practical side of engineering, and confirming theoretical concepts taught in lectures. In 2005, the School of EE&T embarked on a process of complete degree program revision, in part to ready itself for the next round of Engineers Australia accreditation. The outcome of the revision process was a degree with significant and increased laboratory component. Practically all electrical engineering courses offered in the degree program had a weekly or fortnightly lab session of 2 or 3 hours duration. Although it is felt that such an exposure to labs is a vital component in the achieving of graduate outcomes, the increase did have implications on the lab resources available, namely equipment, lab space, and lab availability.

Within the School of EE&T, Ming Sheng was responsible for designing and implementing a Distributed Teaching Laboratory facility in 2010, which enabled laboratory classrooms to be "connected" via similar technology to that used in the virtual classroom, that is, interactive electronic whiteboard, cameras and video recording facilities. The concept is illustrated in Figure 3 below. An additional flexibility was immediately gained with this facility, whereby students would be able to undertake the lab exercises at the same time in different lab rooms, and still have access to common demonstrations. Difficult exercises and concepts could be demonstrated in one room, and streamed into the others, in the form of the captured video image, but also any writing and/or drawing annotations on the electronic whiteboard. Overhead cameras allow for zooming in on lab hardware, such as electronic circuits, facilitating the close-up view and demonstration of good lab practice and more challenging concepts.

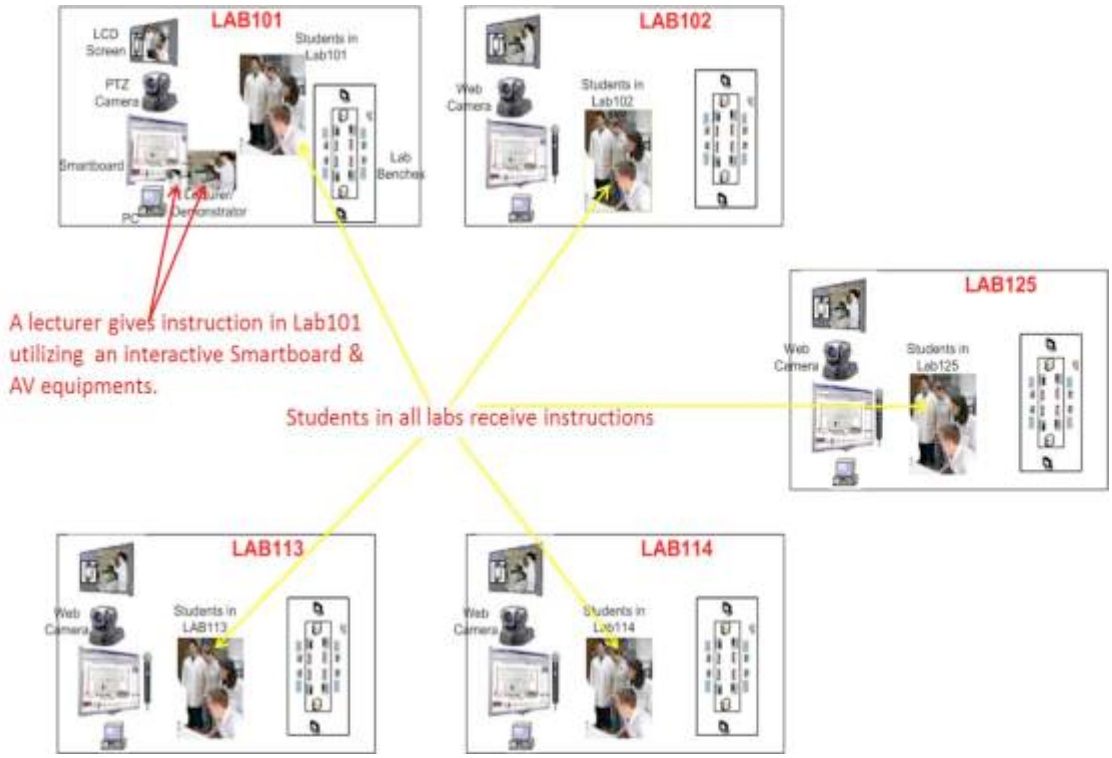

Figure 3: Distributed Teaching Laboratory

Not only can this provide a relief on laboratory teaching resources, but importantly, it is a useful additional educational resource for the students, who are provided with a better quality and more efficient, recordable demonstration, not otherwise possible previously. The Distributed Engineering Laboratory facility is gradually seeing more use within the School. Currently is it of particular use in a both first year and final year design courses, the latter of which tests the student's proficiency and competency in core electrical engineering concepts, and which requires students (80-120 in total) to undertake small design tasks simultaneously. Figure 4 shows the Distributed Teaching Laboratory in use.

Figure 4: The Distributed Teaching Laboratory in use.

3. Educational technology use in the School now and into the future

With the virtual classroom and Distributed Teaching Lab well established, the School of EE&T has been concentrating on the increased utilisation of the technology. As stated, a significant amount of lecture material has now been recorded using the virtual classroom since its implementation.

In particular, the lectures recorded in this way are now used significantly in the School's suite of summer courses. The School runs six summer course currently, over the university summer session (8 weeks instead of 12). As a means of increased flexibility, the courses in summer are run using a blended delivery approach, involving block-mode intensive tutorials and labs, and no face-to-face live lectures. Lecture material is delivered to students via the pre-recorded lectures utilising the virtual classroom. Rather than provide the material via DVDs as was originally done, of course now the more appropriate means of disseminating the material is online, via YouTube and in-house servers. To ensure students are viewing the lecture material and grasping the content, periodic quizzes are implemented, with the quiz result then used to unlock the next set of video lectures.

With increasing worldwide attention on making learning material more open, particularly in the form of MOOCs, the School of EE&T will be taking the intermediate step of availing 1st year courses to high quality High School students. It is hoped that such a step will increase the exposure of the School as well as the discipline of electrical engineering to high schools.

3.1 What does the future hold?

The technological landscape changes rapidly. Although the technology in use within the School of EE&T is still valid, valuable and effective, it is time now to turn our attention to the future and capitalise on new technology to improve the student learning experience. With the proliferation of iPads and small tablet devices, a significant proportion of the student population is already in possession of such technology. For this increasing student cohort with these devices, they are a natural part of their lives, and tools which they are quite intimately familiar with. There is much debate about whether they are, or will be, effective tools in the student learning experience. iPads and other tablet devices, as well the their software, are being increasingly used and trialed in an educational setting, predominantly in high schools (K-12) currently, although with some exposure in the tertiary sector [12-14]. In [15], the authors comment on the increased student engagement from students via the use of iPads inside and outside the classroom.

The School is now embarking on a program of introduction of iPads and/or tablet devices into our teaching. It is hoped that iPads and tablet devices can assist students and facilitate them in becoming more engaged in the learning process, as well as further promoting self-directed learning. In this program, the School/University is not providing students with devices, and so will make the assumption that not all students own a device. The introduction of the devices therefore, is limited to selected teaching staff, with the aim of seeing how to improve the learning environment and process for students. In other words, how they can add value to our teaching methodologies.

In order to further explore possible uses and their effectiveness more broadly, collaboration in this area has been initiated with Taylor's University in Malaysia. The Faculty of Engineering at Taylor's University is introducing innovating teaching methodologies in its Foundations in Engineering program, which includes the provision and use of iPads to students. Among several innovations, the use of iPads is focused on the flexibility and power of the iBooks app. It is intended that courses in the Foundations in Engineering program will be offered as MOOCs. With all students being provided with an iPad at Taylor's University, the approach employed is already contrasting and will provide for useful comparisons. Both student and teacher perspectives can be obtained at both UNSW and Taylor's University.

Additional contrast will be provided through the use of different apps. Broadly speaking, apps for both the generic task of teaching, in other words the pedagogy, and discipline specific apps exist and will be explored within the School of EE&T at UNSW.

The task of generic teaching can be aided by many apps, such as those for presentation, collaboration, and mobility. Within the School of EE&T, the semester has just started, and we have yet to see any impact on the use of iPads and tablet devices. However we have earmarked several assistive technologies for trial within courses now (although not limited to these):

- *Explain Everything* – a feature rich presentation app for the iPad which enables dynamic annotation and page insertion, and recording facilities. This is arguably the mobile equivalent of the virtual classroom described above, except for the video capture of the lecturer as shown in Figure 1.
- *Airserver* – this software when installed on a PC or other Desktop/Laptop, provides a network access point, which when connected to wirelessly from an iPad, enables the iPad to mirror its screen to the server machine. The advantage of such a server lies in the lecturer mobility achieved. That is, the ability of the lecturer to be mobile within the lecture room space with the iPad's screen contents displayed on a projector screen connected to the server machine. Multiple devices can be connected to the server. This capability will have limited use, and may be quite useful in smaller classrooms, particularly where group work may take place – as long as each group has an iPad or tablet, they may display their work to the rest of the class.
- *Polleverywhere* or *Top Hat Monocle* – these are web-based polling or online homework tools. These tools do not require students to have an iPad or tablet device, nor a smart phone. Use in the lecture classroom simply requires students to have the ability to SMS. Smart phone or iPad users can access the tools via the internet though. Such tools may be used to get immediate feedback from students within a class, or to ask quiz questions within a class (or outside the class) and get immediate responses and results data.

In the discipline of Electrical Engineering and Telecommunications, there is definitely a shortage of usable and effective apps. Among those which show good promise as a teaching aid, *iCircuit* will be trialed. This app promises to be of particular use in fundamental electrical engineering courses for junior students in their first two years of an undergraduate degree, including electrical circuits, digital circuits, circuits and signals, and analogues circuits. Examples of circuits created in *iCircuit* are shown below in Figure 5.

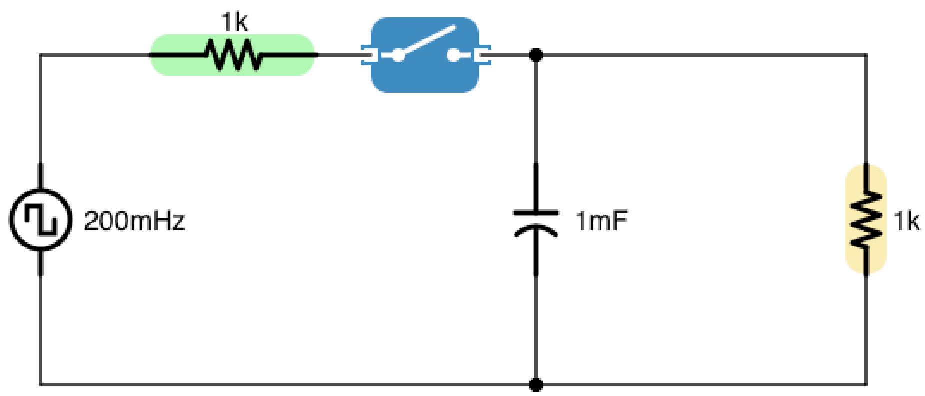

Figure 5: *iCircuit* example 1

4. Conclusion

This work has described the evolution of the use of educational technology in the last decade within the School of Electrical Engineering and Telecommunications at UNSW. The introduction of the virtual classroom and Distributed Teaching Lab have provided valuable resources for the betterment of student learning within the School. This technology will continue to be used in to the foreseeable future. The School, in collaboration with the Faculty of Engineering at Taylor's University will now look to the future and the use of iPads and/or tablet devices to assess their impact on the student learning process. As the iPads are introduced and utilised within courses this semester, student feedback and data will become available and can be compared with that from Taylor's University.

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From Flipped to Open Instruction: The Mechanics Online Course

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Abstract

We describe the development of the Mechanics ReView and Mechanics Online courses. In the first half of the paper we present the history and operation of these courses. We describe the impact of several features, including the use of frequent and embedded assessment to improve e-text reading rates, and multiple explicit levels of homework problem to target students of varying skill levels. In the second half of the paper we give special attention to the most recent versions of the course: an online course in the spring of 2012 oriented toward those seeking a review of introductory mechanics, and one in the summer of that year primarily advertised towards teachers. Comparing and contrasting the two courses shows how changes in the audience, timing, and structure of a course can alter certain outcomes (e.g. attrition rate, reaction to frustration) while leaving others (e.g. student opinions of various course components) almost untouched. Especially notable is the improvement in student retention of students who attempted at least part of the second assignment from 44% to 74%, a value typical of elective on-campus courses. The course will be offered again in summer 2013. (http://RELATE.MIT.edu/physicscourse).

1. The History of Mechanics ReView

Mechanics ReView was initially developed as a reformed on-campus course with online materials that enable a flipped classroom (where in-class time is spent on problems and acquiring new information is done primarily at home). This evolved into an open online course, Mechanics Online. This progression is in contrast to most current-generation MOOCS, which are built for online use, generally resemble traditional on-campus courses, and are now touted as vehicles to reform on-campus education by flipping the classroom.

The impetus for Mechanics ReView was a common student plea for help: "I've read the book, I understand what was said in class, but I can't start the problems." From a cognitive perspective, textbooks teach declarative and procedural knowledge, assuming that the students will learn strategic knowledge by themselves. Many traditional lecture-based courses do the same. To help students learn strategic knowledge, the RELATE group developed a pedagogy called Modeling Applied to Problem Solving (MAPS).

MAPS is a strategic, systematic approach to problem-solving based on categorization of student knowledge into models. The basic knowledge of Mechanics is represented as five core models (similar to but distinct from the models separately developed by Hestenes[1]). Each model specifies the types of system to which it applies, the interactions that change the variable of interest (velocity, momentum, mechanical energy, angular velocity, or angular momentum) and the equation governing that change. Students are then taught a systematic approach to problem solving called SIM, for System, Interaction, and Model. SIM tells students to plan a solution based on explicitly picking a System, identifying the important Interactions, and selecting an appropriate core Model.

MAPS was first implemented during Mechanics ReView, a short course during MIT's January term. Students in this course had received a D in MIT's introductory mechanics course the previous Fall. The course ran for three weeks of classes, two hours per day. In this time, Mechanics ReView brought the class average on a precalibrated final exam from the D the students had received in December up to the class average. Eighty percent of course time was spent with students working at the whiteboard in pairs on multi-concept problems while staff members circulated to help and challenge them. The remaining 20% was instructor comments and some preplanned group activities interspersed through the classes. This approach has recently been called the "flipped classroom." The Colorado Learning Attitudes toward Science Survey indicated an increase of nearly 15% in the expertise of the students' attitudes towards learning science (as opposed to the 10% reduction typically observed in large introductory courses, including MIT's own). This was described in detail at PERC 2009 [2]. Moreover, these students' performances in the following Electricity and Magnetism course exceeded a prediction based on their fall term grade by half a standard deviation, relative both to students not taking the ReView and to those required to take an additional semester of introductory mechanics. [3].

To help with this ReView, postdoc Andrew Pawl led the RELATE group to create online resources [4] containing explanations of the models, how they interrelate, many worked examples using the SIM approach, and a glossary. These formed the basis of our current e-text.

When the January course proved to be effective, the Spring introductory mechanics course – a full-semester course mainly targeting students who failed or dropped the fall course – was reformed using the MAPS pedagogy. In order to teach students with a weaker background in mechanics, a complete online e-text was created by adding the principal topics in the standard introductory mechanics syllabus. Each major topic was presented as a core model, illustrated by worked examples using the SIM approach.

To better prepare students for class, we added computer-graded homework to this e-text by moving it on to the LON-CAPA platform [5]. A substantial amount of the course's written homework was replaced with online homework, with about one third of the new problems coming from the LON-CAPA library. Details on the goals and design of this environment were presented at PERC 2010 [6].

In the transition from Mechanics ReView to Mechanics Online we intended to create an open online course that remained suitable for a flipped classroom. For this reason, the course was based on both our classroom experience and relevant research findings. We embedded checkpoints in our text and shortened text pages to enhance participants' reading experience. In writing our e-text we paid close attention to novices' documented misconceptions and difficulties with fundamental concepts. The e-text was further informed by feedback received from on-campus students answering reading questions. Additionally, we embedded the text with resources like PhETs [7] that have been proven to stimulate learning.

This work allowed us to address an important long-term goal for our group: creating a free open-source online learning environment for mechanics. Given that the online students lacked class sessions to clarify the e-text, we added checkpoint questions between and sometimes within the e-text modules (they were used in the on-campus course in spring 2012 as well). Our online course was entitled Mechanics Online and was first offered in the spring of 2012, and again in the summer of that year. We present some of the significant findings from those courses and the differences between them later in this paper.

Mechanics Online has recently been moved to the edX platform, and is being tested in this spring's on-campus course. (The process involved replacing many LON-CAPA problems, as we did not have author permission for the use of those problems outside LON-CAPA.) A stand-alone version of Mechanics Online will be offered in the summer of 2013 as Mechanics ReView, with increased emphasis on the MAPS pedagogy and publicity aimed at attracting teachers.

2. How Mechanics Online Works

Mechanics Online is organized into units and modules, in the same way that a textbook is organized into chapters and subchapters. Each module consists of web pages with instructional content, videos, and worked examples. Checkpoint questions, generally considered easier than the homework questions, are interspersed through most modules. Homework questions of varying difficulty (see section 2.1) are found at the end of each unit. These problems require participants to choose an answer or enter a numeric or symbolic response. Multiple attempts are allowed. The answers to all homework problems are displayed after the due date. Tools on the site allow participants to check on their progress. Although participants can navigate the course resources in any order, most follow the course sequence quite closely through each unit but skip around in the homework.

Grades were calculated based on two measures: checkpoint questions and homework. In the online course there were also quizzes at the end of most units. Interweaving instruction and assessment in this course was an intentional choice: frequent exams have been shown to substantially increase the amount of material that students read or view in a course [8], as well as having other desirable effects such as reducing cheating [9]. Courses with frequent assessment can see 80% of students reading 80% of the available text.

Participants had access to discussions at the bottom of each page, where they could post questions, answers or comments. Participants used these to discuss problems and concepts with each other, and to alert course staff about issues with the material. Staff intervention in these discussions was kept to a minimum, and course staff only stepped in when forum-goers gave answers to the homework directly (uncommon) or became uncivil (very rare).

2.1 Homework With Different Level Problems

Homework was presented at three levels. Level 1 problems (1 point each) typically involve just a single concept or calculation. Level 2 problems (2 points) involve more than one concept or more involved mathematics. MIT Exam Level problems (3 points) have additional complexity and challenges. Participants were required to obtain 15 points per unit, from any combination of problems whose point total was typically ~ 45 points. This scheme allowed weaker participants to earn full credit without attempting MIT-level problems, while providing rewarding challenges to participants with stronger physics skill.

Scores and times for these problem types and for the checkpoint problems were analyzed for the on-campus spring 2012 course. (We are performing similar analyses for the Mechanics Online course.) Clear differences between the problem types can be seen in the mean scores, as well as on student-averaged median times for a first attempt – see Figure 1. We were surprised to see that the probability of mean percent correct varied only between 40% and 60%, but the time varied between ~75 and ~200 seconds. Rather than rewarding skill, we were primarily rewarding time spent on the problems [10].

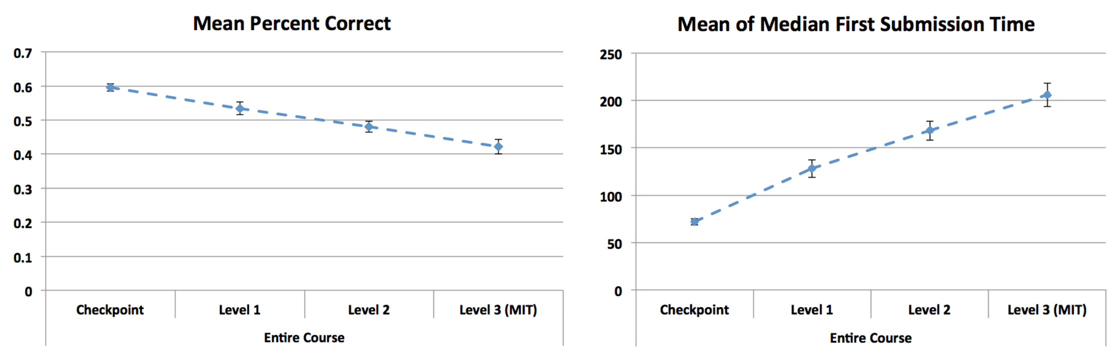

Figure 1. Mean percent correct by problem type, and median time (in seconds) to first attempt. Dashed lines guide the eye. Data from spring 2012 on-campus course

3. Comparison Between Spring and Summer Courses

The spring and summer offerings of Mechanics Online were offered in the same format, on the same platform (LON-CAPA), with a nearly identical set of resources and problems. The summer course offered greater flexibility of its schedule: materials were posted many weeks in advance, and the test deadline was extended 1 week past the homework deadline. Participants were able to work ahead and complete material early if they needed to clear time for a vacation.

Due to the large number of teachers in our spring course the summer course was advertised to (and successfully attracted) physics teachers, whose demographic impact was significant. Details can be found in Section 3.2.

The strong similarity of content in the two courses allowed us to better examine the effects of the few differences that did exist. Information about the courses comes both from survey information and analysis of data gathered by the LON-CAPA platform.

3.1 Enrollees and Persistence

The spring course had an initial registration of 2240, ~400 of whom attempted at least one question in the course. 55 participants were issued a certificate. The summer course had fewer registrants: 850, ~280 of whom attempted at least one question. However, 117 of them received certificates, substantially more than in the spring. Comparing participants who attempted at least 25% of the second homework to those who received certificates, the summer course's retention rate was 74%, whereas the spring's was 44%. Figure 2 illustrates retention in these two courses. The plot shows how many participants registered, attempted any course activities, completed the second homework, or passed the halfway mark for every one participant who received a certificate. MITX's Circuits and Electronics, or 6.002x, a MOOC that attracted ~150,000 registrants and gave 7,158 certificates, is included for comparison.

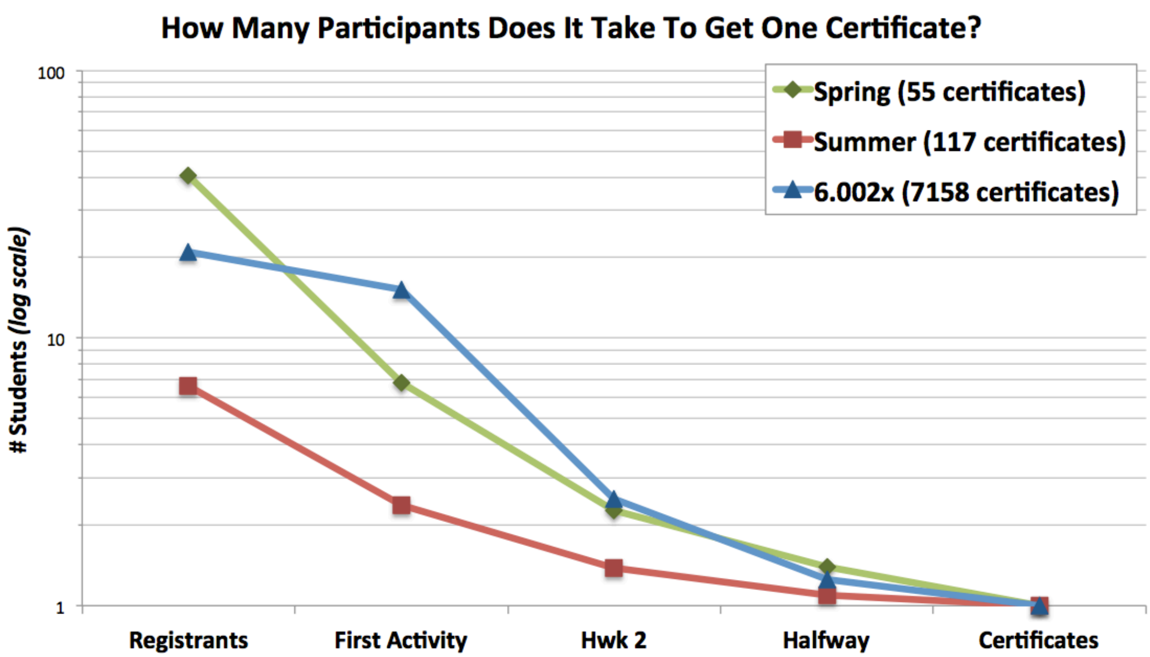

Figure 2: Number of participants active at certain stages of the course for each student who received a certificate. Note the logarithmic scale.

There are several possible reasons for this increase in retention. First, participants may have appreciated the extra flexibility in the course's timing. Second, the greater percentage of teachers in the course may have resulted in a course demographic more prone to academic persistence. Third, The summer version made the last 3 units in the course optional (out of 14 units), which may have let some people finish who otherwise would not have. A combination of these factors seems likely.

3.2 Who were our enrollees?

Two surveys were given in each online course: one in the first week of the term, and one after the last week. Approximately 300 participants answered the beginning-of-term survey in the spring, compared with 440 in the summer. About 50 participants answered the end-of-term survey in the spring, with 70 responding in the summer.

Figure 3 shows the level of physics knowledge of enrollees who responded to our initial survey in the spring and summer courses. We were surprised at the large fraction of physics teachers who enrolled in our spring course. This led us to intentionally market the summer course toward physics teachers. Our goals were not merely to increase numbers through targeted marketing, but also to help teachers and to efficiently spread MAPS pedagogy. Continuing Education Units for American high school teachers were also arranged through the American Association of Physics Teachers. Over 45% of the summer enrollees who answered the survey were physics teachers and ~ 90% of the certificate recipients were teachers (about two thirds high school and one third college).

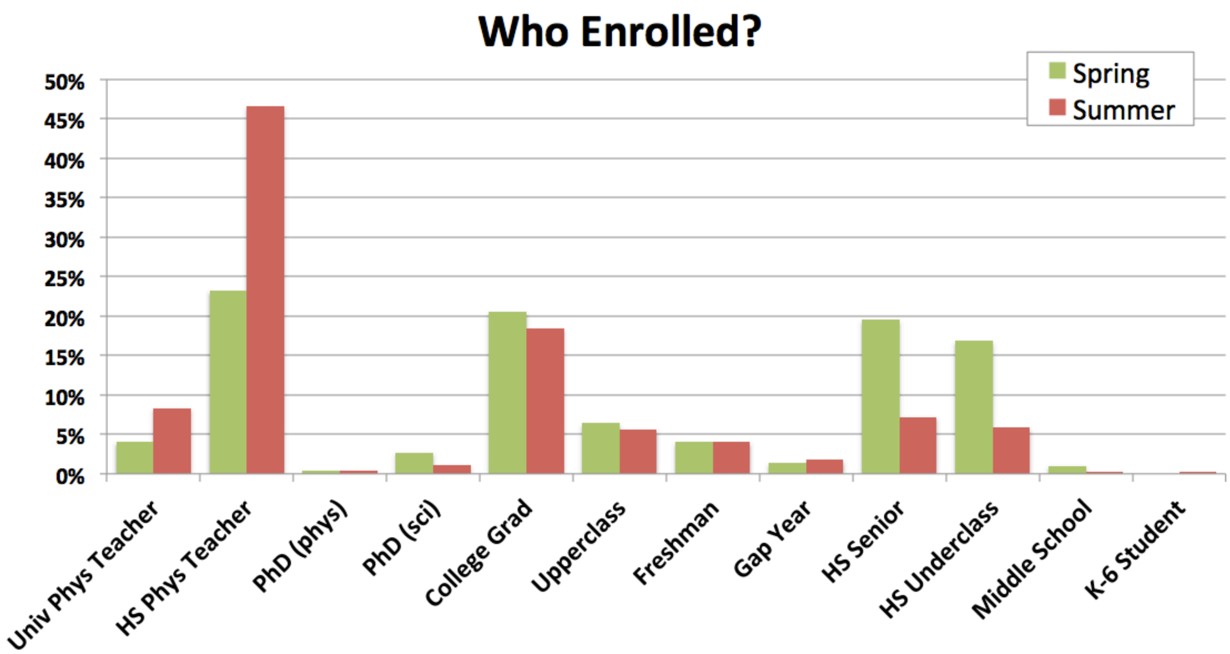

Figure 3. Enrollees in Mechanics Online

As one would expect, enrollees in the summer course had generally taken more than one year of college physics, whereas those in the spring generally had not. Mathematics proficiency was also higher among the summer participants.

3.3 End of Term Surveys

The spring and summer end-of-course surveys showed agreement on many points. Participants appreciated the course for its many high-quality challenging problems. They found the homework absolutely essential to the course. Many also found the discussion boards to be very useful and the discourse there of high quality. On the negative side, there were complaints about the interface in LON-CAPA, some related to navigation and others related to the method of inputting equations. Many participants also expressed a desire for more time, and (especially in the spring) for greater flexibility in the schedule of the course. Others were interested in having particular resources available, such as detailed solutions, sample problems, or improved discussion forums.

Survey respondents listed two main reasons for taking the course: “Interest Only,” and to “Review Physics.” Other options presented in the survey included preparation for AP exams, for advanced standing exams, or “other.” More spring participants were taking the course for their own interest only, while more summer participants were there to review physics.

Relative to spring, summer participants found the course to require more independence. They also exercised more independence when stuck. One survey question asked respondents what they did when they were “stuck, frustrated, or had a question.” Summer participants gave an average of 2.0 responses each (citing such actions as taking a break, checking in a textbook, using the discussion forums, or checking elsewhere online) vs. 1.4 responses for spring. (This aligns well with survey data taken from physics courses using online homework at UMass Amherst [11], where a greater number of responses were seen in a course for physics majors than in a calculus-based service course.) Correspondingly, the spring participants both found the homework more indispensable and appreciated the MAPS pedagogy more than the summer participants. Summer participants, meanwhile, were more likely to be satisfied with their understanding of the material at the end of the course.

3.4 Completion Certificates and Teacher Certification

Participants who completed Mechanics Online with a certain percentage were issued a certificate. These showed participants the number of points they earned on homework, their percentage on the quizzes, and their total time spent in the course, both in absolute terms and relative to the rest of the class.

The range of times actually spent on the course by these individuals was substantial. The median time spent by certificate earners was 43.7 hours, with a standard deviation of 25.9 hours. To highlight a dramatic example, one participant spent only 7 hours in the course and achieved a score of 59%, while another spent 106 hours to achieve a 58%. An examination of survey responses showed that even participants who completed the course were not accurately able to estimate the amount of time they would need to spend in the course each week.

High school teachers from the USA who took Mechanics Online in the summer of 2012 were also able to obtain Continuing Education Unit certificates from the American Association of Physics Teachers. Because of the interest in this certificate, the RELATE group later became certified to offer similar certificates for the state of Massachusetts.

3.5 Lessons Learned

We pause here to describe two missteps in developing Mechanics Online, in the hopes that others can benefit from our negative results.

First, during the Spring Mechanics Online, course content was initially released one week at a time. Quizzes were only visible for 33 hours, from Friday noon to Saturday evening. Participants had 3 hours from the time they opened the quiz to complete it. Several participants complained about the limited time of the quiz, and asked for more flexibility with material release and with quiz schedule.

For the summer release, course material, including quizzes, was released in advance (1/3 of the course was released at launch, 1/3 after 2 weeks, and 1/3 after 4 weeks) to allow participants to plan ahead around the due dates. Quizzes were timed, so that participants still only had 3 hours to finish the quiz (and could only attempt the quiz once), but the quizzes were open as soon as the associated material was released and participants could attempt them at any time. We suspect a positive effect from this change on retention, as the summer survey showed fewer complaints about the tightness of the schedule.

Second, the summer 2012 offering of Mechanics Online included online "office hours" shown live via Google Hangouts. Participants in the course were encouraged to submit questions on each week's material via discussion board, as well as to vote up the questions they wanted to see answered. They could then view the professor or other course staff discussing the questions with a pair of undergraduates during "office hours." The goal was to create a tutoring-like environment, to improve student understanding [12]. Unfortunately the highest live viewership was 2, numerous technical problems plagued the video broadcasting, and the office hour videos were ranked significantly below other videos on the end-of-term survey. Substantial retaking, reviewing, and editing time was invested to make these into modular discussions of each question, which seem valuable to us. However, in retrospect it would have been preferable to prerecord office hour videos. Quality would have been higher, and thought could have been given to making them more reusable even if the particular homework question they involve is not used in the course in future years.

4. Summary and Future Goals

In this paper we have discussed a calculus-based open online mechanics course that can also be used in flipped classroom instruction. Unlike most online learning environments, this course was developed from online materials created for an on-campus course. This on-campus course teaches a standard mechanics syllabus using a flipped classroom with a new pedagogy (MAPS) that is designed to increase student expertise in problem solving.

This online course met our objectives: increasing both students' expertise about learning, and their problem-solving ability, in a way that carries forward to their subsequent physics course. These objectives were achieved through construction of a complete set of research-based online resources centered on a short e-text. This course has been subsequently improved by adding additional videos and problems. The course's homework has recently been enhanced with research-based problems similar to those found in TIPERS [13] and the Mechanics Reasoning Inventory [14].

Several research opportunities present themselves as we move to future versions of the course. The greater number of participants that seems likely with edX not only allows for greater accuracy in statistical measurements, but also makes new statistical approaches possible. We hope to use Multidimensional Item Response Theory to examine student skill and problem difficulty along several axes, which will enable us to determine whether the various types of research-based problems actually present significantly different challenges to students. We hope that implementing Bayesian Knowledge Tracing will enable us to determine which elements of the course help students learn most effectively.

4.1 The Benefits of Teaching Teachers

Survey results showed that physics teachers were a large component of our Spring 2012 course. Therefore, we advertised our Summer 2012 course to attract teachers. We ran advertisements in the National Science Teachers Association's "NSTA Express" e-mail newsletter, in the AAPT's "eNNOUNCER" e-mail newsletter, and posted on various free event calendars.

Marketing the course to a particular audience (especially *this* particular audience) seemed very successful. More certificates were awarded in the summer than in spring, with 90% going to teachers. The appreciation that teachers had for Mechanics Online was attested to by the many who requested copies of the homework, quiz problems, and other online materials for use in their own courses. We believe that such specialization has contributed to the low attrition rate observed in the summer course. We speculate that the plethora of open online courses currently being developed and deployed will ultimately be adapted and targeted to specialized audiences, and that when this happens their attrition rates will decrease.

Creating an open online course may have more than just philanthropic benefit. We suspect that teachers also appreciated the opportunity to obtain continuing education units without the hassle of attending a workshop that might last for a week or more. Institutions interested in spreading the use of a particular technique, pedagogy, or set of materials have the opportunity to build strong relationships with teachers by presenting those materials for free. Our group sees a tremendous benefit to our objective of spreading our MAPS pedagogy and materials to the many high school and college students whom each teacher reaches each year.

5. Acknowledgements

We appreciate the aid of RELATE member Yoav Bergner and RELATE visitors Stefan Droeschler, Gerd Kortemeyer, Stuart Raeburn, and Sara Julin. We acknowledge Sarah Lancaster for her work in editing and proofreading. RELATE is grateful for support by NSF grant NSF DUE-1044294, a Google Scholar Grant, and MIT.

We thank the many people who have helped write the e-text and problems include: Boris Korsunsky, Jonathan Abbot, Sophie Bai, Vesal Dini, Margarita Esteban, Grace Huckins, Sara Julin, Andy Liang, Lauren Merriman, Stephen Wilk, Maria Cassidy, Zixi Liu, Mary Delaney, and the LON-CAPA author pool that included John Ballback, Gerald Feldman, Gan Kangfei, and Frank Lee at GWU, Ed Kashy at MSU, and Craig Weigert and Angela Fertig at UGA.

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"Sources of knowledge" for students entering a gateway science course

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Abstract

Epistemology has been shown to have an important role on how students learn. The current paper focuses on one epistemological dimension, which is the "sources of knowledge" for students entering a gateway science course. Eight students were interviewed and asked about their sources of knowledge, and sources of physics knowledge. The qualitative analysis revealed that the students' sources of knowledge, and sources of physics knowledge range from relying on the teacher, lecture, on peers, textbooks, Internet resources, experiences, or on experiment. Students who mentioned experiments as their sources of knowledge emphasized the importance of lab work. These findings have implications on teaching physics, and on designing classroom and online courses, and especially on current phenomena such as, the flipped classroom, and Massive Online Open Courses (MOOCs). Based on the study, policy recommendations are provided.

Introduction

One of the major problems that students face when they enter gateway science courses is that for them the language of science is similar to a foreign language [1]. Another problem is that students enter these courses with preconceptions and epistemologies that may interfere with learning. Unfortunately, students' scientific knowledge is characterized by a knowledge-in-pieces viewpoint rather than intuitive theories [2]. Moreover, students' epistemological knowledge in introductory courses is mostly at the dualism stage of Perry's scheme [3], in which students see the world in a dualistic fashion involving the opposites of Right-Wrong, Good-Bad, and We-They, Truth is absolute, and any uncertainty can only be temporary [3].

Epistemological knowledge (or epistemic beliefs[1]) may not always be explicit, articulate, and consciously-held [5, 6], but it can have an important effect on learning and performance [7], on self-regulation [8]. Epistemic beliefs are multidimensional [9, 10]. Some of these dimensions (that are mainly the result of factorial analyses of the instruments measuring epistemological beliefs) are the following: (1) source of knowledge, (2) sophistication of knowledge, (3) certainty of knowledge, (4) justification of knowledge, and (5) attainability of truth. Audi [11] distinguishes between five sources

[1] "Epistemological knowledge" and "epistemic beliefs" are used interchangeably [4] Chinn, C. A., Buckland, L. A. and Samarapungavan, A. L. A. Expanding the dimensions of epistemic cognition: Arguments from philosophy and psychology. *Educational Psychologist*, 46, 3 (2011), 141-167.

of knowledge. These sources of knowledge are: (1) perception, (2) memory, (3) consciousness, (4) testimony, and (5) reflection. Perception is a source of knowledge which comes through the senses by seeing, hearing, smelling, feeling or tasting an external matter, memory is a "storehouse of what we have learned in the past", consciousness is "revealing our inner lives", reflection (including rationalism and empiricism) is "a way to acquire knowledge of abstract matters", and testimony is a "source of knowledge originally acquired by other people" [11]. These five sources of knowledge are "sources" of knowledge in the sense that they are processes for acquiring, forming or developing it. This means that these sources of knowledge are actually "ways of knowing", which when employed result in different forms of produced knowledge. Since these ways of knowing are qualitatively different, they may result in different kinds of produced knowledge.

Purpose

Uncovering students' epistemologies before instruction is crucial for forming the baseline of students' knowledge. Indeed, understanding students' epistemologies can help an instructor choose the pedagogical tools and resources, which can establish favorable learning environments for the students. Specific interventions are thought to affect, and help students change their epistemologies, enhance their approaches to learning conceptual knowledge, and develop a more coherent framework of scientific knowledge [12]. For example, specific instructional activities were shown to be effective in scaffolding students and making them view the course in a holistic manner [13]. Some of these activities include the Reflective Writing Tool [14], which can enhance students' understanding of concepts found in textbooks. Another example of these activities is the Conceptual-Conflict Collaborative-Group exercise [15], which can also enhance students' conceptual understanding [16].

There is ample evidence that identifying student prior knowledge plays a crucial role in designing successful learning environments [17]. Historically the focus of researchers was on identification of student prior content knowledge [18, 19] and their potential difficulties in learning. Student epistemologies are an important facet of prior knowledge that affects student expectations and approaches to learning [20]. Nevertheless, researchers and educators have often neglected this knowledge. Uncovering how students think about science and its ways of knowing is important in design and implementation of successful learning environments [21]. It is especially important in designing virtual technology enhanced learning environments where students have much more control over their learning than in a face-to-face classroom. The purpose of this qualitative pilot study is to probe one aspect of epistemologies of first year science students: how students perceive the sources of knowledge in general and knowledge in the context of a science (physics in particular).

Methods
In the current study, a convenient sample[2] [22] of eight students, and conduct an interview that examines their epistemological stances, and specifically as to how these stances affect learning. The students are undergraduate first-year students enrolled in an introductory physics course in a college in Canada. The reason we decided to conduct the study in this context is that introductory physics, more than any other first year science course, requires students to think conceptually, which often clashes with their preferred mode of learning [20].
Although the sample size may appear small, it is sufficient for the purpose of our qualitative study, based on the factors to be considered for determining sample size [23]. Specifically, these factors are: (1) the scope of the study, (2) the nature of the topic, (3) the quality of the data, (4) the design of the study, and (5) the use of shadowed data (where participants talk about the experience of other participants). Based on these criteria, the sample size is enough to provide us with the quality of data that helped in answering our research questions.

The interview was designed to tap into students' epistemological knowledge and their learning. In the current paper, we focus on the analysis of the two questions that related to the sources of knowledge. The first question is: How do you get knowledge? Or How do you acquire knowledge? In this question the student is asked about their sources of knowledge in general. The question is open-ended, and is not related to any specific kind of knowledge. This is done purposefully, so that the student can answer without any restrictions. The second question is: How do you get physics knowledge? Or How do you acquire physics knowledge? In contrast to the first question, which was asked about knowledge generally, this second question asked about physics knowledge specifically. The purpose is to see what sources of knowledge students rely on in order to "get", or "acquire" the scientific knowledge of physics.

The interviews were recorded, and transcribed. Transcripts were then coded according to a coding scheme that represents the different sources of knowledge. The coding is described in the Data Analysis section.

Data Analysis
Students' interview data relating to the sources of knowledge, and sources of physics knowledge were coded according to the following five codes. According to [11], it is possible to classify the sources of knowledge into the following sources: (1) perception (Code 3: current experience), (2) memory (Code3: past experience), (3) consciousness, (4) reason (Codes 1 and 2: reasoning and experiment), and (5) testimony (Codes 4 and 5: Teacher, School, Lecture and Book, Movie, TV or Internet). Consciousness relates to the knowledge of the self, and is not applicable as a code here. Perception (which was coded as "current experience"), and Memory (which was coded "past experience") were combined in the code "Experience". Reasoning refers to inductive or deductive logic, and thus could refer to using logical deductive reasoning, or inductive reasoning based on making conclusions, and acquiring knowledge based on the results of an experiment.

[2] A "convenient sample" is an easily accessed sample, and does not require a lot of time, money or effort to obtain

The first code is “Experiment”. This code means that the student acquired knowledge through an empirical procedure. We used this code to see how the student tries to reason inductively. This means that the student tries to form knowledge based on inductive logic arising from the knowledge constructed based on the results of an experiment. The second code is “Reasoning”. This means that the student relies on thinking and reasoning to conclude what knowledge is, or how they acquire knowledge. Reasoning in general includes both deductive and inductive reasoning. However, in this study, we used the code “reasoning” only for deductive reasoning. The third code is “Experience”. This means that the students rely partially on their historical or memorial knowledge as a source of knowledge. The fourth code is “Teacher, Lecture, or Peers”. In this category, the students relied on external sources of knowledge. They relied on testimony from a person, which could be the teacher or a friend. The fifth code is “Book, Movie, TV, or Internet”. In this category, the students relied on informational resources. Sometimes they mentioned “Google”, or “YouTube”. Sometimes, they mentioned “Discovery Channel”. This code also is also related to “Testimony” as a source of knowledge, but the testimony here comes from a source of information that is not a person they meet face to face.

Results

The results are shown in Table 1. They show that the most common source of knowledge for the students is the teacher, followed by the textbook and other sources such as the Internet. Some students reported that they rely on experience to get knowledge, or physics knowledge. Some students also reported that they rely on experiment.

Students who reported that they rely on experiment as a source of knowledge emphasized the importance of using an experiment and using actual “physical” procedures. Table 1 shows coding of the students’ sources of knowledge, and sources of physics knowledge. Table 2 shows excerpts of the students’ data “verbatim”.

Discussion

Implications for Learning, and Instruction. An important point that our analysis revealed is that for knowledge acquisition, the students we interviewed still relied mainly on lecture, and on instruction, followed by textbooks. This means that the students did not feel empowered to be able to generate valid physics knowledge by themselves and they have to turn to experts for it. This places students in a very passive knowledge receiver position that is not conducive to helping them develop critical thinking and reasoning skills that are the core of science. This might explain why the majority of science students enrolled in traditional lecture introductory science courses are doing so poorly on conceptual tests [24] that require critical thinking and reasoning, while they do relatively well on traditional tests requiring students to reproduce the knowledge they acquired during lectures. This may also explains why instructional methods asking students to provide explicit reasoning, reflect and evaluate scientific ideas, in other words, revisit the way how they learn science had been shown to be effective in that regard [13-16].

Another important point to highlight is that some of the students that we interviewed expressed that they relied on experiments to acquire knowledge. Courses that offer “theoretical” content knowledge without relating it to practical applications and students’ everyday life tend to make students rely on “authority” for knowledge acquisition, without being able to see how this knowledge has come about. Experimentation is a vital part of science (especially physics) and it should be integrated in instruction not only in order to illustrate theoretically derived physics concepts, but also to engage students in the process of scientific discovery to help them discover these concepts for themselves [25].

Another important finding of the study is that none of the students that we interviewed reported that they use their own reasoning when first asked about where they get knowledge, or, physics knowledge. However, most of the students would agree that they use reasoning, once they are asked if they use it as a source of knowledge. Yet it is disappointing to see that despite all the availability of resources[3] that can help students to learn how to think independently, and ample evidence in support of active learning, many undergraduate science students are still passive learners.

A major problem in attempting to deal with these concerns is that approximately 50% of incoming college students have not reached the intellectual stage of development where they can think abstractly (i.e. scientifically) [26]. Such students prefer concrete facts to concepts. Moreover, courses that lack activities, demonstrations, labs, and experiments are short of an important aspect of helping these students develop their epistemologies that help them in learning. Demonstrations and experiments carry very little pedagogical value, unless students are challenged to think independently in order to analyze and predict the results of these demonstrations: they might help students enjoy the class, but the students will not learn much from them [27]. Recent attempts to address this problem in large classes use modern technologies, such as electronic response systems and live data collection technologies to engage students more actively in the learning process and encourage their reasoning as opposed to passive acceptance of knowledge from authority [28].

Implications for Technology-Enabled Education (TEE). TEE offers very important tools for learning and instruction. However in utilizing such tools and in designing classroom, online courses, as well as MOOCS, instructors and designers need to take into consideration pedagogical factors, such as the importance of using experiments to help students acquire knowledge in an “empirical” way, and especially for those students who have greater difficulty understanding the basic concepts presented in the course unless the course includes experimentation, and hands-on activities. As mentioned above, modern technology provides unprecedented opportunities to engage students in active knowledge acquisition as opposed to passive knowledge acceptance from authority. Electronic response systems pioneered by Eric Mazur in late 80s allowed instructors to utilize conceptual questions helping students develop reasoning skills [29]. Even in large introductory science courses the implementation of these systems in order to engage students actively in learning has shown to be very effective [24]. Modern research-based computer simulations such as PhET [30] provide students with an unprecedented opportunity to test their ideas and ask “WHAT-IF” questions. Moreover, there is

[3] See www.compadre.org and www.perug.org

scientific evidence that virtual scientific experimentation is often more effective for the students than a hands-on science activities [31]. Data collection and analysis technologies allow instructors and students to collect and analyze data easily and in-expensively both in terms of time and resources [32]. Also, Technology-enabled learning tools employing social-based interaction such as PeerWise [33] that asks students to design their own science questions and critique the questions of others, is another way of how technology can be used to help develop student scientific epistemologies.

However, there are also challenges associated with designing successful technology-enhanced learning environments. Educators have to acquire Technological-Pedagogical Content Knowledge (TPCK) [34], the knowledge of how technology can be used to promote student learning in a particular subject context. The "source of knowledge" facet of epistemology construct discussed in this paper should be taken into account while designing learning environments. Based on our discussion, we provide a brief list of policy recommendations in the next section.

Policy Recommendations

In this section, we draw on our conclusions and discussion to provide a brief list of policy recommendations. These recommendations are:

1- Instructors should take into consideration students' epistemologies when they start a course, because these epistemologies affect how they learn during the course.
2- Instructors should take into consideration students' ways of knowing, or how they acquire knowledge, because these sources of knowledge affect how they learn, and what they focus on during learning.
3- Instructors are encouraged to use instructional methods, and activities that promote deeper learning, more conceptual knowledge construction, and more sophisticated epistemological beliefs.
4- Instructors are encouraged to employ technology-enabled tools and resources that have been show to promote students' learning.
5- Assessment should include evaluating students' epistemic knowledge, because this knowledge can show the depth of their learning, and whether it is passive or active.
6- The design of learning environments should be based on principals of learning, and to facilitate knowledge acquisition, and knowledge creation.
7- Science curricula should include authentic experiments, simulations, demonstrations, or hands-on activities that aim at helping students understand and construct knowledge.
8- Online courses, blended learning environments, and MOOCs should incorporate learning that goes beyond teaching content knowledge and problem solving. We recommend that these learning environments incorporate real lab work, experiments, or similar activities that engage the students in modes of learning that promote different kinds of knowledge acquisition, including deductive, and inductive reasoning.

9- We recommend using social learning tools that show favourable learning results, and especially those that help students become more active learners who seek to acquire and construct knowledge.
10- We recommend using evidence-based instructional methods, as well as theories and frameworks that integrate learning, teaching, assessment, epistemology, and technology to guide instruction, and instructional design.

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Table 1: Students' sources of knowledge, and sources of physics knowledge

Epistemic Knowledge	Inductive Reasoning		Perception or Memory		Deductive Reasoning		Testimony			
Codes	Experiment		Experience (Current or Past)		Reasoning		Teacher, Lecture, Peers		Book, Movie, TV, or Internet	
Student	K	PK	K	PK	K	PK	K	PK	K	PK
KK			X				X	X		X
CJL			X				X	X	X	
ADM	X	X					X	X	X	X
BB							X	X	X	X
HT				X			X		X	
DW				X			X	X	X	
JL		X					X	X	X	X
HW			X						X	X
Frequency of Codes	1	2	3	2	0	0	7	6	6	5

X = code is present

K = Knowledge

PK = Physics Knowledge

Table 2: Comparison between pre and post students' sources of knowledge, and sources of physics knowledge

JL	Before I study in here, I study physics in Korea, I usually get the knowledge from textbook, read some book. But here, I think, I am getting the experience from experiment. So it's very, you know, awesome. You know, I see the situation you know, in real, you know. Oh, now I understand why it happens, so, I like studying here.
JL	Then experiment is very fun. It makes me understand very well
ADM	Ah…physics has a lot of…ah…experimental. So I find that learning through lecture is beneficial, but also doing…ah…watching demonstrations, and the lab portion of the course really helps me visually understand why we are learning, not just like mathematical formulas, but actually seeing it applied in real life.
CJL	I am not very good at physics. Everything is kinda like math thing for me. But if you just talk about how you like, how you calculate the thing and I don't really get it through by math. In order to really understand, doing the demo is the best thing for me. Or the thing that I can really feel it. Otherwise, by drawing the forces, not really. I don't really feel to know. I don't know. You have to really feel it. Cuz it's PHYsics, it should be physical…

Active Learning Electronic Resources and Tools for Inquiry on Tablet Devices

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Abstract

The purpose of this paper is to present a research-based compendium of Active Learning Electronic Resources and Tools (ALERTs) for Inquiry Active Learning (IAL) and their uses in Education in general, and in Science Education in particular. In this paper, we focus on tools and resources that can be used on tablet devices, such as the ipad. The intention of the paper is to present a sample of tools that can be useful in accomplishing inquiry tasks. When students are involved in inquiry such as research, or project-based learning, they become active learners, and follow a question that they are motivated to investigate. Tools and resources become indispensible for inquiry tasks, and implementing them using easy-to-use applications on tablet devices can offer new opportunities for creativity. Although the number of applications is increasing in specific categories, such as, applications for presentation and applications for whiteboarding, and screencasting, yet applications for quantitative and qualitative data analysis are very limited in functionality, and make the use of stand-alone non-tablet devices sill important for completing the inquiry cycle.

Introduction

In Science Education, different implementations of Inquiry-based instruction that engage students in activities, projects, cases, or research projects promote students' Active Learning (AL) inside and outside the lab or classroom. Engaging in any form of Inquiry Active Learning (IAL) involves a plethora of tasks and activities that can be carried out by the student alone, or by groups of students engaged in a community of learners. Making observations, collecting data, analyzing data, searching for information, solving problems, engaging in group discussions in a classroom or online, or constructing and presenting knowledge are all examples of IAL tasks and activities. Accomplishing these IAL tasks and activities necessitates using various tools that can be used to facilitate reaching the learning goals. Today, many standalone, community-based, as well as collaboration-centered Active Learning Electronic Resources and Tools (ALERTs) are available to help students accomplish the various Inquiry activities and tasks, and promote their AL in science. Open Educational Resources (OER), and Massive Open Online Courses (MOOCS) are examples of newly available learning resources that students can use in their IAL tasks and activities. Cloud-based collaboration, tablet-based apps, technological tools for flipped classrooms, interactive lecture response systems, and other Technology-Enabled Education (TEE) tools are examples of new tools that can engage students in AL, and more specifically IAL. Higher quality and successful accomplishment of IAL tasks and activities depend on students' knowledge of the appropriate resources and tools and their effective use. In many cases, students, and teachers may not be knowledgeable about various ALERTs and their effective use. This gap may possibly hinder learning, decrease motivation, cause lower engagement, or contribute to lower achievement.

Purpose

The purpose of this paper is to present a research-based compendium of tablet-based ALERTs and their uses in Education in general, and in Science Education in particular. This ALERTs compendium would serve as an ideal learning tool by itself. Knowing about existing ALERTs, their capabilities, and their effective use can direct students towards the appropriate tools and resources, and help them conceptualize alternative learning strategies. Students can use the compendium when they are working on an IAL task or activity by themselves or within a community of learners. Science teachers can also consult the compendium to help them design IAL tasks and activities. Some resources and tools in the compendium may be more relevant to specific science disciplines such as physics or chemistry, while other resources and tools may be general for any discipline.

Context

The literature on Inquiry provides different conceptualizations of what Inquiry represents. One of these conceptualizations is that it "involves developing and implementing a plan to satisfy curiosity, collecting data, evaluating evidence, drawing conclusions, reflecting on strengths and weaknesses of the plan, and engaging in a new sequence" [1]. Enacting Inquiry requires many skills, techniques, and knowledge in order to perform the various tasks involved in inquiry. For example, in reference [2], 36 research skills were listed for inquiry as research. In our paper, the emphasis is on the tools (the ALERTs) that can help accomplishing various Inquiry Active Learning (IAL) tasks on tablet devices.

Methods

We searched three popular education technology websites for tools that can be used for different inquiry tasks. The websites are: (a) www.edudemic.com, (b) www.edutopia.org, and (c) www.classtechtips.com. We searched two mash-up websites, which are: (a) Pinterest (www.pinterest.com), and (b) Learnist (www.learnist.com). We also searched the Apple App store. In addition to these searches, we have included the tools that we use for various inquiry steps. We organized the tools according to their use in inquiry.

Data Analysis

The resulting tools and resources were categorized according to different tasks of Inquiry. During inquiry, students need tools to collect and organize information, create bibliographies, brainstorm ideas, refer to specific discipline-based material, consult peers, analyze data, write documents, create presentations, posters, collages, audio or video presentations, or blogs. All these tasks can be performed during an inquiry, and all of them require specific resources or tools to help students accomplish these tasks.

Results

In this section, we outline the tools and resources that can be used in inquiry.

1. Collecting and organizing information is essential for inquiry. Students who work on projects search for information that is relevant to their questions. The next step is for the students to collect and organize the information that they find and decide that it is important and relevant to their investigation. The following tools can help students collect, and organize the information that they find:
    a. Pocket (www.getpocket.com): Pocket is an app that allows saving web pages, photos, audio or video.
    b. Readability (www.readability.com): Readability is an app that allows archiving digital content for offline consulting.
    c. Evernote (www.evernote.com): Evernote is a tablet-based app that allows the students to capture ideas, photos, recordings, or just about anything else on your their accounts, access it anywhere, and keep it organized.
    d. Diigo (www.diigo.com): Diigo lets the student use web-pages like paper-based material, making it simple to highlight, bookmark, take notes, or even add sticky notes.
    e. Pinterest (www.pinterest.com): Pinterest let students pin just about any image they find interesting on the Pinterest site. Many teachers are also using it as a place to collect great lesson plans, projects, and inspirational materials.
    f. MentorMob (www.mentormob.com): Mentor Mob allows students to create a learning playlist, which is essentially a collection of materials that can be used to study a specific concept.
    g. Learnist (www.learni.st): Learnist allows combining resources such as videos, ebooks, maps, blogs, podcasts, surveys, and pages. The tool is like a collaborative multimedia and interactive ebook.
2. Managing a bibliography is a very important skill in inquiry. When a student completes inquiry, communicating the results is what demonstrates the work accomplished. The work that the student does is related to a field or a discipline, where resources are the building blocks on which the student builds the inquiry. Referencing the consulted work, and citing resources shows the student's the breadth of the information search and investigation. Many apps exist to help students manage references and bibliographies. Some of these apps are:
    a. EndNote (www.endnote.com): EndNote is a classical bibliography management system that can help organizing references.
    b. Sente (www.thirdstreetsoftware.com): Sente is a reference manager and database search tool. It allows reading and editing PDF files, as well as searching databases, such as Google Scholar or Web of Science.
    c. Papers (www.mekentosj.com/papers): Papers is a reference manager and database search tool. It allows reading and editing PDF files, as well as searching databases, such as Google Scholar or Web of Science.
    d. Mendeley (www.mendeley.com): Mendeley is a reference manager that also allows reading and editing PDF files.
    e. Bookends (www.sonnysoftware.com): Bookends is a reference manager and database search tool. It allows reading and editing PDF files, as well as searching databases, such as Google Scholar or Web of Science.
3. Conducting inquiry requires discipline knowledge. Understanding discipline knowledge, and knowing gaps in the knowledge base of a discipline lead to more innovative inquiry

projects. The proliferation of university-offered courses in the form of Massive Open Online Courses has made consulting course content in many courses easy and feasible. Students who are motivated to investigate an inquiry, and lack specific course content knowledge can find this knowledge with more ease from various institutions that offer high quality course material. Some of the sites that offer the discipline-based knowledge are:

a. Coursera (www.coursera.org): Coursera offers free courses from 62 universities, where students can take classes, watch lectures, and learn at their own pace
b. edX (www.edx.org): edX offers free classes from 12 universities in many subjects, such as biology, computer science and statistics
c. Open Learning Initiative (OLI) (from Carnegie Mellon University): OLI offers free online courses to anyone who wants to learn or teach.
d. Udacity (www.udacity.com): Udactiy offers free online classes, as well as certificates of completion.
e. Udemy (www.udemy.com): Udemy is a commercial site that offers many practical professional development courses.
f. Khan Academy (www.khanacademy.org): Many students use this excellent collection of math, science, and finance lectures and quizzes to supplement their learning materials.
g. iTunes U (www.apple.com/education/iTunes-U/): iTunes U is a platform that students can use to access courses offered by many universities that use iTunes U to present their courses.
h. TED-Ed (ed.ted.com): TED-Ed offers a growing video library that educators can use to teach a lesson, or students can use to learn.
i. Youtube EDU (www.youtube.com/education): Youtube EDU offers students a large video library of educational material, such as lectures, speeches, and professional development training material.

4. Social learning is learning through a community of learners. Inquiry is deeply rooted in constructivist theories [3-5], Social Constructivist theories [6-8], as well as Socio-Cognitive theories [9, 10]. Websites and tablet-based apps have incorporated "social" features, where users can share and collaborate using different platforms. Some of the social learning tools are the following:
    a. Edmodo (www.edmodo.com): Teachers and students can take advantage of this social network Facebook-like environment, where classes can connect online.
    b. Edublogs (www.edublogs.org): Edublogs allows users to create educational blogs. This is very useful for both students and teachers to share knowledge, as well as learn together, by asking questions, offering answers, materials, and links to resources.
    c. Wikispaces (www.wikispaces.com): Share lessons, media, and other materials online with your students, or let them collaborate to build their own educational wiki on Wikispaces.
    d. Quora (www.quora.com): Quora offers a social network site for asking and answering questions. It can connect students in useful discussions related to class material.
    e. Openstudy (www.openstudy.com): Openstudy can help students work together on class material.

5. Analyzing data is an important skill in inquiry. Analytic skills include categorization and classification, comparing and contrasting, finding relationships, or plotting graphs.
    a. Inspiration (www.inspiration.com): Inspiration is a tablet-based app that can help student create concept maps that translate their ideas into shapes and figures. Inspiration offers templates for qualitative analysis of a character, a plot, a civilization, an event analysis, or an innovation. This can be helpful for students who are guided to analyze their data.
    b. Maxapp (www.maxqda.com/products/maxqda11/mobile-app): Maxapp is a qualitative analysis tool that enables users to use icons to code data.
    c. Tagcloud (www.tagcloudapp.com) : This is an app that can generate maps (or word clouds), where the size of the most frequent words is proportional to the frequency of occurrence of the words in a text.
    d. OmniGraphSketcher (www.omnigroup.com/products/OmniGraphSketcher) : OmniGraphSketcher provides users with tools to plot graphs on tablets
    e. JMP Graph Builder (www.jmp.com/software/jmp10/jmp-graph-builder-for-ipad.shtml): JMP Graph Builder provides users with the ability to import data from Dropbox, and interact with the data in different ways to visualize and represent the content of the data.
    f. Numbers (www.apple.com/ca/apps/iwork/numbers/): This is a native spreadsheet app from Apple. The app runs on the iPad, and offers classical spreadsheet capabilities, such as inserting rows and columns of numbers, sorting values, and representing numerical data in graphs.
6. Creating a model, a mind map or a concept map involves representing ideas and solutions through figures and relationships. Brainstorming is important in order to get the ideas out and represent them. When the ideas are represented, and have a form and shape, they are easier to express and communicate, and also share, and use for collaboration. This can also lead to refining the ideas, and discovering hidden relationships. Modeling is also an important task in inquiry. A student can model ideas at the stage of brainstorming, or at the stage of analysis or making conclusions about the inquiry investigation. Various tools exist for mind mapping, concept mapping, brainstorming and modeling. These tools share the common feature of allowing the user (or student) to represent ideas through shapes, and try to connect the shapes through lines that represent a link or a relationship. Today, many apps exist on tablets to help students accomplish the task of brainstorming, or modeling with ease. For example, the following apps offer students simple interface and tools for brainstorming and modeling:
    a. Notability (www.gingerlabs.com/cont/notability.php): Notability is a tablet-based app that can simplify the workflow between teachers and students, who can use it to create, retrieve, annotate and submit work.
    b. Penultimate (www.evernote.com/penultimate): Penultimate is a tablet-based handwriting app. The app allows students to draw, write, present concept, or model their ideas
    c. Popplet (www.popplet.com): Popplet is a tablet-based app that allows students to brainstorm ideas, create mind maps, share, and collaborate.
7. Writing a report that explains the inquiry is important to communicate the steps taken in the investigation, the results, and the conclusions. In most cases, a written report or essay

is required from students, where they have to demonstrate their learning. Many apps exist to help students accomplish the writing task. Some of these apps are:

   a. Quickoffice (www.quickoffice.com): This app offers a complete office suite for the tablet.
   b. Plaintext (www.hogbaysoftwre.com/products/plaintext/): This is a simple text-editing app.
   c. iA Writer (www.iawriter.com): This is a simple text-editing app.
   d. PaperDesk (www.mypaperdesk.com): This is a text-editing app that provides simple handwriting capability in addition to typing.
   e. Pages (www.apple.com/ca/apps/iwork/pages/: This is a native word-processing app from Apple. The app runs on the ipad, and offers classical word-processing capabilities, such as editing text, and inserting images and graphs.

8. Presenting an inquiry to audience shows many skills from students. Presentation requires first preparing a well-organized presentation, with appropriate content, language and graphics, and well-timed delivery. Presentation skills also include attention to audience, and communication skills. Many apps exist to help students prepare and deliver presentation. Some of these apps include the following:
   a. Haiku Deck (www.haikudeck.com): Haiku Deck is free and boasts intuitive design with easy-to-use interface, where students and teachers can access presentations directly from the app and via the web. Students can play their presentations directly from the iPad, email them, and share with Facebook and Twitter.
   b. Prezi (www.prezi.com): Prezi is a tablet-based and online tool that makes it simple to prepare a presentation on a big canvas, and zoom in and out to explain concepts embedded in the presentation.
   c. Slideshare (www.slideshare.net): With SlideShare, students can upload their presentations, documents, and videos and share them with other students and teachers.
   d. Speaker Deck (www.speakerdeck.com): Speaker deck is a simple online tool that allows students to share their presentations.
   e. PDF Slides (www.rtmsug.de/pdfslides): This app provides a simple way to show presentations from an iPad on a screen.
9. Creating an audio presentation, audio channel, a podcast, or an audio recording is now a way of communicating information related to the inquiry to audience anywhere in the world. Some tools are very easy to use, and can assist students in recording their narratives, commentaries, audio notes, or a final audio radio-like episode or podcast. Some of these tools are the following:
   a. SoundCloud (www.soundcloud.com): SoundCloud is an online audio library that offers what YouTube offers for videos. SoundCloud is also an app that can be used to record audio directly from a tablet, and upload it to an audio channel.
   b. Audiboo (www.audioboo.fm): Audioboo allows students to create audio recordings, and upload them directly to the Audioboo website.
10. Creating a screencast is useful way for illustrating concepts, demonstrating ideas or procedural knowledge, and sharing them. Screencasts can be used by students to share their learning, or by teachers who can use them as whiteboards. Some of the apps that provide screencast functionalities are the following:

a. Educareations (www.educreations.com): Educreations is an online tool for the iPad that lets teachers (or students) create screencasts.
b. Showme (www.showme.com): ShowMe is a presentation and screencast creation app.
c. Screenchomp (www.techsmith.com/screenchomp): Screenchomp is a simple whiteboard screencast creation app.
d. Doceri (www.doceri.com): Doceri is a professional iPad interactive whiteboard and screencast recorder with sophisticated tools for hand-drawn graphics and remote desktop control.
e. Baiboard (www.baiboard.com): Baiboard is an interactive collaborative tool for recording screencasts with many options for sharing, and exporting content.

Discussion

Inquiry is a multifaceted activity that involves many tasks. Inquiry normally starts with a question and follows an investigation to answer that question, then present and communicate the results. In every step and for every task during inquiry, various tools are needed in order to accomplish these tasks. In this paper, we presented a sample of tools and resources that can be useful, and help students in implementing their inquiry with more ease on tablets. We find that tablets can be useful learning devices when students use the appropriate resources and tools on them. Tools and resources become indispensible for inquiry tasks, and implementing them using easy-to-use application on tablet devices can offer new opportunities for creativity. Although the number of applications is increasing in specific categories, such as, applications for presentation and applications for whiteboarding, and screencasting, yet applications for quantitative and qualitative data analysis are very limited in functionality, and make the use of stand-alone non-tablet devices sill important for completing the inquiry cycle.

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Conceptual Understanding of Undergraduate Students of Calculus in Cooperative Learning Using Calculus Education Software (CES)

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Abstract

The aim of this study is to enhance conceptual understanding of undergraduate students in the Calculus, a vital branch of mathematics and to find out how students may use different kinds of representations for thinking about the concepts in Calculus. To achieve this, I designed a three level teaching experiment to study the effects of computer assisted interactive teaching of calculus course at undergraduate students. At level one, students' conceptions/misconceptions about calculus especially function concept, ε-δ definition of limit of a function, continuity/discontinuity of function, derivability of function in an interval and at the endpoints were investigated through the activities like diagnostic test (pre-test). At the second level, Calculus Education Software (CES) was developed to get rid of misconceptions and to improve conceptual understanding of the students. After pre-test, three groups of students; control group, experimental group and cooperative group were formed. All the three groups were demonstrated the same topics of calculus using different teaching methods and learning effect was calculated using t-test by comparing mean scores of posttest administered after the treatment.

Introduction:

A number of efforts have been made by mathematics educators in building calculus concepts easier, interesting and motivating without any harm to natural phenomena of the subject. Calculus teaching at undergraduate level had been focused on students' learning strategies, without essentially giving attention to intuition and to the creation of several representations of concepts which contribute to their considerable understanding. Several studies have revealed the positive effects of cooperative and interactive learning, including one to one dialog of teacher with student as well student with student, student's willingness to answer and ask questions, increased level of confidence of students, comprehensive and correct understanding, increased conceptual understanding, and increased ability to apply knowledge in solving problems [10, 15, 17].

In developing calculus concepts in correct and lucid manner, the preconceptions about the topic that fixed in the mental makeup of students that play an important role should be considered. These preconceptions might have been perforated either from teachers who taught them previous courses or the use of the mathematical term of the concept in day to day life. For example, students may have had experiences in everyday life where the word limit is involved as in such cases as speed limit, capacity. Such everyday language connotations may therefore interfere with students' understanding of the mathematical notion of limits. The correct intuitions and the understanding of a concept are taken to evolve through the creation of multiple representations of the concept. It is important that the teaching that uses multiple representations of the concept such as graphical and algebraic might help students to learn and understand with the correct intuitions. Multiple perspectives of the concepts can easily be elaborated by means of computer software or simulations.

Review of literature:

It is widely accepted that calculus concepts are abstract and complex for students to understand. Teaching and learning of these concepts may be challenging and even exasperating at times [8]. Students should construct mathematical knowledge by solving problems and not just memorizing procedures, by investigating patterns and not just memorizing formulas, and by forming conjectures and not just doing exercises [9]. This suggests that multi-dimensional approach should be emphasized in teaching the abstract calculus concepts for conceptual understanding.

Computers in Mathematics Education:

Computers have promoted entirely new fields in the era of mathematics education providing innovative visual ways to represent mathematical information. Computer based instructions in mathematics mainly focus on drills, practice and tutorials which intensify mathematical abilities of learners and stimulates for mathematical thoughts. Research suggests that despite the numerous benefits of using technology in mathematics education, the process of embedding technology in classrooms is slow and complex [3]. Computer algebra systems (such as Derive, Mathematica, Maple or MuPAD) and dynamic geometry software (such as Geometer's Sketchpad or Cabri Geometry) are powerful technological tools for teaching mathematics. Numerous research results showed that these software packages may be used to encourage discovery and experimentation in classrooms and their visualization features may be effectively employed in teaching to generate conjectures [13].

Students' Understanding of Calculus:

Traditional calculus courses tend to focus more on algebraic drill and practice on calculus problems without understanding the underlying concepts. The calculus curriculum should be reformed by putting more emphasis on conceptual understanding of the fundamentals of calculus and complementing the use of graphical, numerical, algebraic and verbal representation in the teaching and learning of calculus. Students' reluctance to visual concepts in calculus was reported by giving examples in which visual representations would solve certain problems almost trivially. Yet it was observed that students refrain from using them because the preference developed over the years is for a numerical, symbolic mode of approach [5, 6]. Algebraic manipulation is the preferred mode of operation for many students. However research shows that visual images may provide vital insights.

The understanding of functions does not appear to be easy, given the diversity of representations related to the concept [12]. Students have difficulties in making the connections between different representations of the notion (formulas, graphs, diagrams, and word descriptions), in interpreting graphs and manipulating symbols related to functions [14]. Researchers had revealed that students who have a coherent understanding of the concept of functions (geometric approach) may easily understand the relationships between symbolic and graphic representations in problems and are able to provide successful solutions. Moreover, it was observed that there is a close relationship between the use of a geometric approach in functions and better understanding of equations, graphs and functions in general [1].

The derivative concept was being explained as a rate of change in one quantity with respect to another quantity. However, presently many students are taught in a way that enables them to solve calculus problems without attending to rates of change [2]. It was observed that students memorized properties of second derivatives but could not relate it while discussing inflection points of the function graphically [2]. Tall (1986) and Ubuz (2007) reported students' difficulties in creating graphical representations of function's rate of change. These researchers found that students often focused on computing derivatives without connecting the derivatives they computed and evaluated to a function's rate of change at specific points in its domain [16, 18].

Research Objectives:

Objective of this study was to investigate students' difficulties in understanding calculus. In order to overcome through the observed difficulties; develop Calculus Education Software (CES) that may enhance conceptual understanding of topics in Calculus.

Methodology:

Since, experimental research provides a systematic and logical method for answering the question such as "Is there a difference in performance between participants who receive treatment A and participants who receive treatment B?" [7]. Here, in this study experimental research design is used.

Sample:

Sample of 60 first year undergraduate students offering mathematics as one of the subjects were selected by simple random sampling from the three colleges affiliated to Pune University. Pune University is well known as a one of the leading university of India. Three colleges from different parts of the city were selected randomly which were easily approachable and ready to provide help for smooth conduction of the experiment. Following, Table 1 shows the colleges and the number of students that were part of the study.

TABLE 1

Participants of the study (Year 2010-11)

College	**Participants**		
	Male	**Female**	**Total**
Annasaheb Magar College, Hadapsar, Pune	08	12	20
Baburaoji Gholap College, Sangvi, Pune	12	08	20
Prof. Ramkrishna More College, Akurdi, Pune	11	09	20

Total	**31**	**29**	**60**

Instrument:

It is essential in any experimental research, to design proper instrument for determining the approximate state of the students' knowledge about the subject. For this purpose diagnostic test (instrument) was administered to the participants. Instrument was containing multiple choice questions (items) on particular topics of calculus especially function concept, limit, continuity and differentiability of a function of a single variable. This instrument which was further considered as the pre-test of the experiment was validated by senior teachers of Mathematics having more than ten years teaching experience. Students had to choose correct alternative for each item with suitable justification.

After the pre-test analysis of students' responses, average difficulty index was calculated to measure the difficulty level of a diagnostic test and found to be 0.44 proving that the test is moderately difficult. Average discrimination index, a measure of the discriminatory power of diagnostic test i.e. the extent to which the diagnostic test distinguishes students who have good understanding of the subject from those who do not, is calculated as 0.34 showing test is good discriminator. To find whether the test is reliable or not, the reliability index of the test has been determined according to Kuder-Richardson method and found to be 0.713 which is acceptable for group measurement [4].

Treatment:

To investigate difficulties in the understanding calculus concept, pre-test was administered to the participants selected for the study. Calculus Education Software (CES) was developed by researcher to accomplish the needs of the conceptual understanding. After pre-test selected sample of 60 students of the first year undergraduate class was divided into three groups, namely control, experimental and cooperative groups. Students of control group were taught the topic by traditional teaching method while for experimental group traditional teaching was supported with the demonstrations using Calculus education software. For both of above groups students had passive role of observing blackboard or CES demonstrations.

Like experimental group, the third cooperative group was also taught with the support of CES initially. Then subgroups of cooperative group, each of three students were formed. One computer was provided to each subgroup and allowed to operate CES under guidance of teacher. Here students were in the mode of active learners. After the treatment, the post-test was administered to three groups of students to measure effects of CES on students' conceptual understanding of calculus.

Computer Education Software

After identifying student difficulties in learning calculus, researcher developed Calculus Education Software (CES) in C programming language on topics including Function concept, Limit, continuity, differentiability, maxima-minima of a function, mean value theorems. Programming language knowledge is not needed to the instructor as well as students to operate the software. Since it is converted to executable file, it runs on double clicking on any computer having windows operating system. No need of installing turbo C compiler. Here the visualization property of software mainly focuses on graphical illustration of the definition of function as well as graphical aspects of injectivity, surjectivity, bijectivity and invertability of a function. Different graphs of standard functions can be drawn and observed the differences which help students in creating mental images about nature of functions. Here user has an option of choosing range for x, different parameters and so on.

Limit and continuity part initially focuses on graphical illustration of deleted neighborhood of a point, ε-δ definition of a limit of a function. It also focuses on how values of δ changes on different choices of ε values in the ε-δ definition. It also demonstrates graphically a number of examples with existence or nonexistence of left hand and right hand limits.

In continuity part, ε-δ definition of continuity of a function is discussed by covering the cases of functions having limit at a point but not continuous thereof. Removable, irremovable discontinuities are interpreted graphically.

In differentiability, differentiability of function at a point, in the interval [a, b], at endpoints of the interval is discussed. How differentiability of a function graphically reflects in discussing the increasing/decreasing nature of function, in finding the points of inflection and maxima-minima of function are interpreted. Mean value theorems especially Rolle's and Lagrange's theorem are illustrated graphically. Illustration of differentiability implies continuity is discussed.

1. Graphical illustration of ε-δ definition of a limit of a function

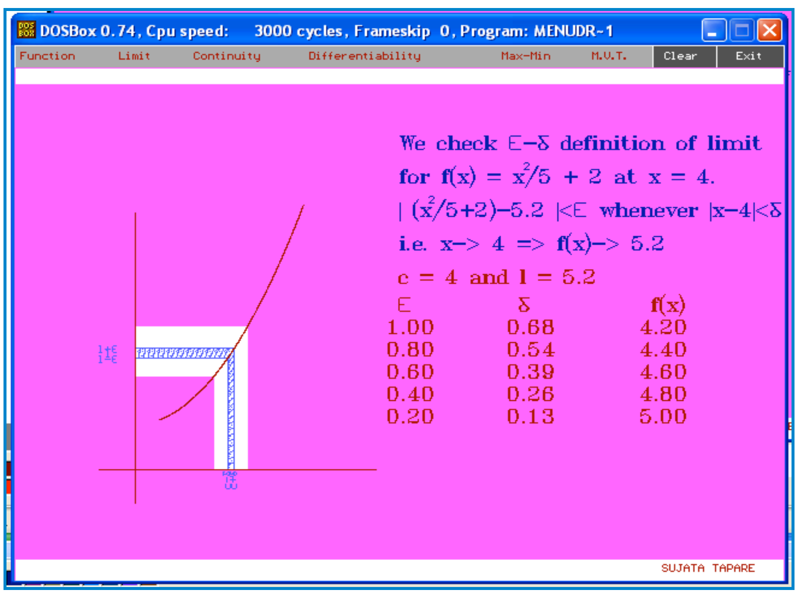


Fig. 1 Illustration of existence of limit using ε-δ def. of limit at point $x = 4$

Here illustration of ε-δ definition of limit is shown for $f(x) =$ — $+ 2$ $\forall x \in [1, 7]$ at $x = 4$. Off course limit l is 5.2. To show that the limit value of $f(x) \to 5.2$, as $x \to 4$, the gradual decrease of ε is demonstrated through animated projection of the interval (l–ε, l+ε) on the curve and at each step corresponding δ-nhd of c i.e. (c–δ, c–δ) is obtained. Students able to visualize that for different ε value, how δ changes and $f(x)$ approaches to l.

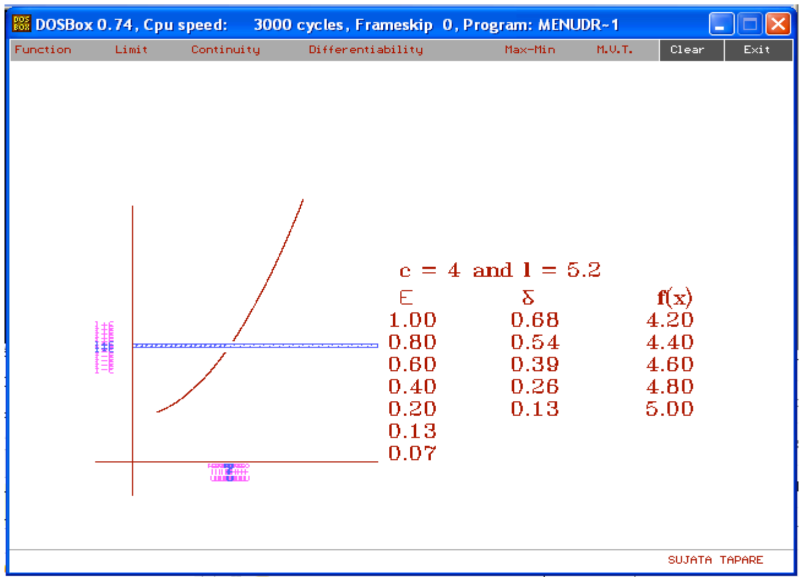


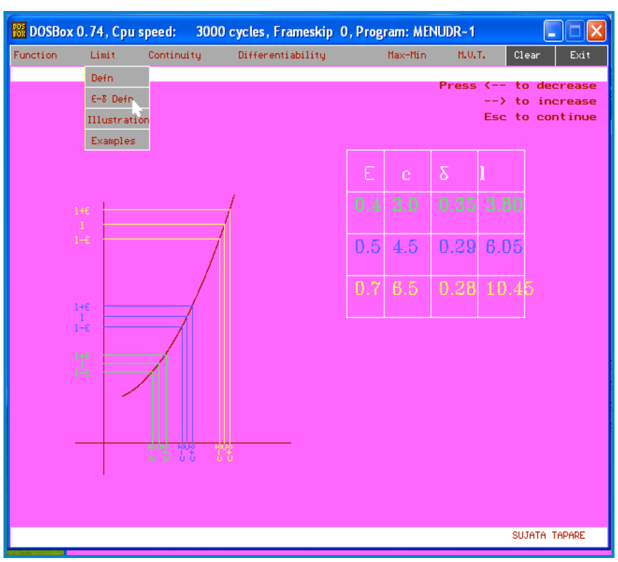
Fig. 2 Illustration of non-existence of limit using ε-δ def. of limit at point $x = 4$

In this animation, limit of *f(x)* does not exist at $x = 4$ is shown for

$$f(x) = \frac{\;}{\;} + 2 \quad \forall\, x \in [1,3.8] \cup [4.1,7].$$

For some values of ε (ε = 1.0, 80, 0.60, 0.40, 0.20) there exists δ satisfying ε-δ definition of limit. But as value of ε decreases it can be observed that δ value cannot be obtained. Thus non-existence of limit is graphically revealed by visualization of non-existence of interval (c–δ, c–δ) corresponding to the *each* interval (*l*–ε, *l*+ε), *for any* ε > 0.

2. Some other screenshot of CES



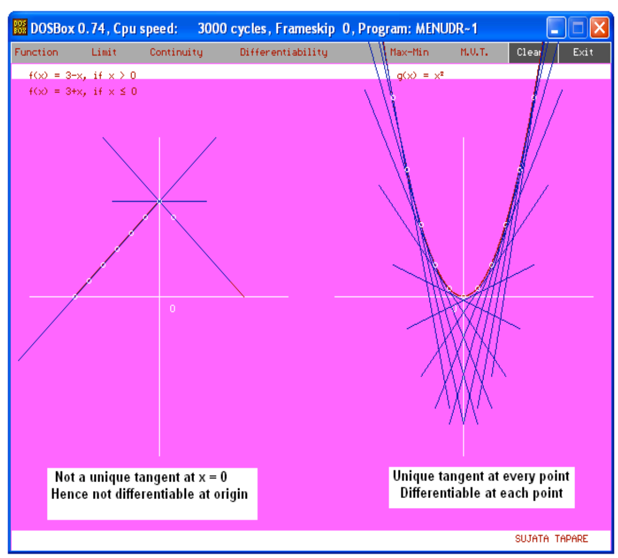


Fig. 3 ε-δ def. of limit at multiple points **Fig. 4 Illustration of Differentiability**

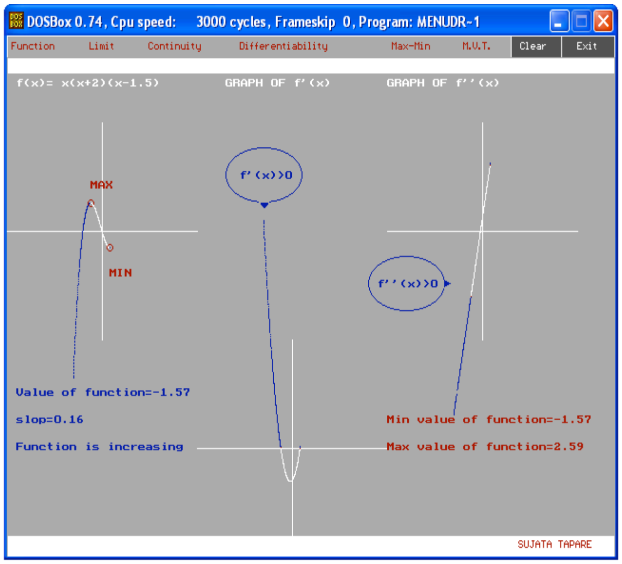


Fig. 4 Illustration of Maxima-minima

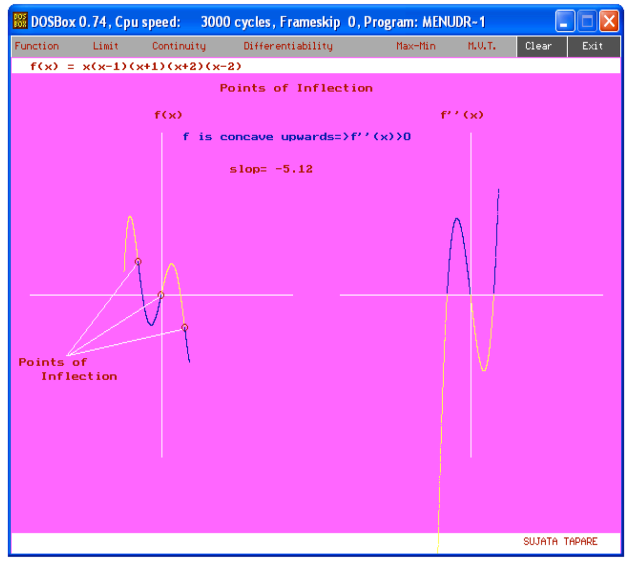


Fig. 5 Illustration of Points of Inflection

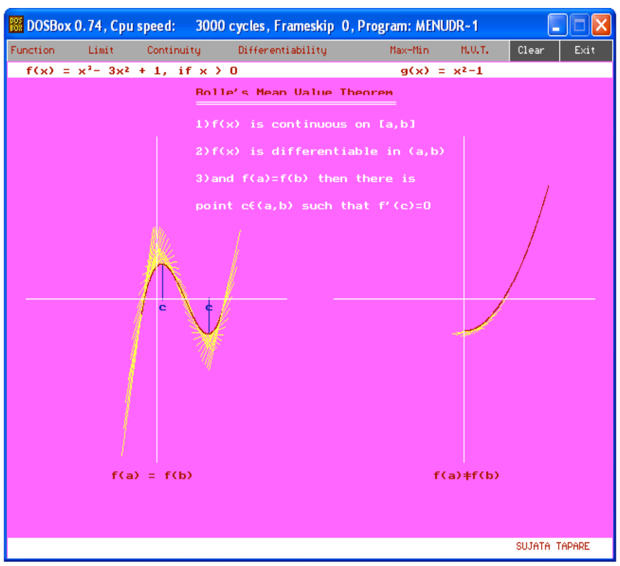


Fig. 6 Illustration of Rolle's MVT

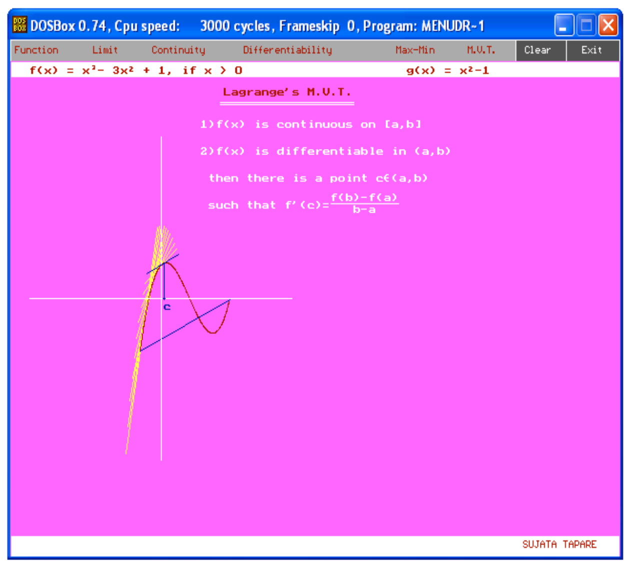


Fig. 7 Illustration of Lagrange's MVT

Data Analysis and Results:

To compare the pre-test and post-test mean scores, the normalized gain method was used. The normalized gain is independent of the pre-test scores that lead us to expect that if a diverse set of classes has a wide range of pretest scores but all other learning conditions are similar, the value of normalized learning gain measured in the different classes would not differ significantly. This independence of normalized gain also suggests that a measurement of difference in <g> between two groups having very different pre-test scores would be reproduced even by a somewhat different test instrument which results in a shifting of pre-test scores. Average normalized gain <g> is a much better indicator of the extent to which a treatment is effective than is either gain or post-test. If the treatment yields <g> > 0.3 for a course, then the course could be considered as in the "interactive-engagement zone." [11]

Initially, using pre-test and post-test scores of each student the normalized gain 'g' of each student of the experimental group and the control group was obtained by using formula,

$$g = \frac{\qquad}{\qquad}$$

Then average normalized gain <g> for each group with its standard deviation was obtained for each group and results are summarized as below in the Table 2.

TABLE 2

Comparison of pre-test and post-test scores

		Group		
		Control (A)	Experimental (B)	Cooperative (C)
Pre-test	**N**	20	20	20
	Mean	37.78%	38.44%	37.08%
	S. D.	14.82	16.18	15.36
Post-test	**N**	20	20	20
	Mean	39.78%	58.67%	73.84%
	S. D.	12.56	12.31	13.81
<g>	**Mean**	0.0321	0.3286	0.5842
	S. D.	0.102	0.131	0.146

To compare effects of different treatments on the three groups, the *t*-value and p-value were obtained, using average normalized gain and corresponding standard deviation of each group. The *t*-value between every pair of group was compared with t_{critical} at the 0.01 level of significance as shown in the following Table 3

TABLE 3

Comparison of t-values and p-values in between the groups

	Groups A and B	Groups B and C	Groups A and C
t- value	7.986	6.885	13.86
p- value	1.19×10^{-9}	3.52×10^{-8}	1.92×10^{-16}

[For significance, t_{critical} = 2.71 at 0.01 level for df = 38]

Table 2 shows that the average normalized gain for experimental group was found to be <g> = 0.3286 and that of control group was found to be <g> = 0.0321. The *t*-test was conducted on normalized gains of these groups. The difference between two normalized mean was significant at the 0.01 alpha level of significance (t =7.986). Since the average normalized gain for experimental group is greater than 0.3, the treatment used for experimental group is almost *ten times* effective. The average normalized gain shows that the CES supported teaching of calculus in the classroom is effective than the traditional teaching method in promoting conceptual understanding.

Table 2 shows that, the average normalized gain for experimental group was found to be <g> = 0.3286 and that of cooperative group was found to be <g> = 0.5842. The t-test was conducted on normalized gains of these groups. The difference between two normalized mean was significant at the 0.01 alpha level of significance (t =6.885). The average normalized gain for the cooperative group is *1.77 times* effective than the experimental group.

From Table 2, the average normalized gain for control group was found to be <g> = 0.0321 and that of cooperative group was found to be <g> = 0.5842. The t-test was conducted on normalized gains of these groups. The difference between two normalized mean was significant at the 0.01 alpha level of significance (t =13.86). The average normalized gain for the cooperative group is *eighteen times* effective than the control group.

Conclusions and Suggestions:

The finding of this study suggests that the instructional method used by researcher is effective in enhancing mathematical reasoning skills and conceptual understanding of calculus at undergraduate level. The study also indicates that computer aided instructions have greater potential to advance a conceptual change by helping students to move from their misconceptions to correct conceptions. But if additional support of cooperative learning using CES is provided to students then a large gain in conceptual understanding has been observed. From this study, researcher suggests that computer assisted learning with the aid of either suitable, effective mathematical educational software or self developed software (by analyzing misconceptions about the respective topic to end up difficulties in understanding and induce proper and clear concepts that result significantly), convey significant change in conceptual understanding of students. It was observed that the computer tool 'CES' intended to help students to learn and understand the concepts in calculus by facilitating enriched environments of interactive learning as well as found helpful tool for teachers to explain abstract concepts through powerful visualizations.

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Parallel Presentations

Session #6
The Internet and Education: Case Studies from around the World, Part 2

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"Many Hands Make the Load Lighter": Haitian Creole and Technology-Enhanced Active Learning Toward Quality Education for All in Haiti

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Making technology-enabled education available to *all* around the world.
The title of the LINC 2013 conference is: *Realizing the dream: Education becoming available to all. Will the world take advantage?* This title brings to mind the situation of Haiti where education has never been available to all because of brutal socio-economic barriers, including a well-entrenched language barrier—that is, French spoken by a tiny élite (no more than 10% and perhaps as low as 3%) vs. Haitian Creole aka "Kreyòl" spoken by all. My contention in this article is that the Haiti case should serve as a key lesson for current efforts to make technology-enabled education available to all around the world.

Under the leadership of Dr. Vijay Kumar (Director, MIT Office of Educational Innovation and Technology[2]) and myself, and with the help of colleagues from MIT and Haiti, we've begun, since 2010, an "MIT-Haiti Initiative" to develop, evaluate and disseminate Kreyòl-based and technology-enhanced resources for education in Science, Technology, Engineering and Math aka "STEM." In Kreyòl, we call these resources "Resous pou edikasyon san baryè" (that is, resources for education without barriers). Based on new educational technologies that have been developed at MIT, we are working toward the creation and dissemination of high-quality resources that use Kreyòl as an indispensable tool toward improving change the educational system in Haiti. So doing will, in turn, strengthen Haiti's educational system. This is the first

[1] There is an amazingly powerful dedicated team behind this article: the MIT-Haiti team http://haiti.mit.edu , all the teachers who participated in workshops conducted in Port-au-Prince in March 2012 and January 2013, and the teachers and students of the Lekòl Kominotè Matènwa in La Gonave. The MIT-Haiti team is directed by myself and Dr. Vijay Kumar, Director of MIT's Office for Educational Innovation & Technology. There are many individuals and organizations to thank. Unfortunately there isn't enough space to include everyone's names—apologies—but I must single out: Lourdes Alemán, Audy Alvarez, Yves Armand, Paul Belony, Tatiana Behrmann, Sara Bonner, Fedo Boyer, Alison Brauneis, Ivica Ceraj, Pierre Michel Chéry, Yves Dejean, Iramène Destin, Cecilia d'Oliveira, Peter Dourmashkin, Ilio Durandis, Ruthly François, Elena Geretti, Lesha Greene, Mary Grenham, Josiane Hudicourt-Barnes, Janin Jadotte, Nirvah Jean-Jacques, Dale Joachim, Philip Khoury, Jessica Kloss, Tom Kochan, Janet Kolodner, M.S. Vijay Kumar, Richard Charles Larson, Judith Leonard, Chris Low, Serge Madhere, Kenneth Manning, Haynes Miller, Brandon Muramatsu, Jacques Pierre, Jean Milou Pierre, Michèle Pierre-Louis, Carline Rémy, Abner Sauveur, Chuck Shubert, Glenda Stump, Lindja Trouillot, Jocelyne Trouillot, Nuriel Vera-DeGraff, Féquière Vilsaint, Emily Wade, Laura Wagner, Flore Zéphyr, *CreoleTrans*, *EducaVision, École Supérieure Infotronique d'Haiti, École Normale Supérieure* (UEH)*, Faculté de Linguistique Appliquée* (UEH), *Faculté des Sciences* (UEH), *Fondasyon Konesans ak Libète* (FOKAL), *Haiti Fund of Boston Foundation, Hotel Le Plaza*, *Komite Òganizason Kolòk sou Akademi Kreyòl Asyiyen*, *Komite Entènasyonal Etid Kreyòl*, *Lekòl Kominotè Matènwa*, *MIT*, *NATCOM*, *National Science Foundation* (U.S.A.), *Office of Educational Innovation & Technology* (*MIT*), *Open Society Foundations*, *Université Caraïbe*, *Université d'État d'Haïti, Université Quisqueya, Wade Fund.*

[2] http://mit.edu/vkumar/www/ , http://oeit.mit.edu

time that experts have created various materials and technologies in Kreyòl for active learning in STEM at the university and high-school levels.

The LINC call-for-papers states:

> "With today's computer and telecommunications technologies, every young person can have a quality education regardless of his or her place of birth or wealth of parents."

But what about the *language(s)* spoken by those young persons' parents and peers, the *language(s)* spoken in their homes and communities? My hunch is that, if designers of technology-enabled educational resources do not pay due attention to the world's linguistic diversity (including local languages such as Kreyòl), technology-enabled education will not, and *cannot*, become available to all. More over, by ignoring the world's linguistic (and cultural) diversity, we also miss out on the opportunity to learn as much as we could about different ways of learning. Indeed, online learning offers a great opportunity for "a global laboratory for rigorous learning about learning" (in the words of MIT President Rafael Reif) and such laboratory can be greatly enriched by the world's cultural diversity when it comes to learning—an additional opportunity not to be missed.

These challenges set up the larger context for this paper: How to address the linguistic impediment to education for all? How to mine the world's cultural diversity for pedagogical assets to enrich online learning? We take Haiti as our case study to answer this challenging question, one that is particularly relevant to efforts such as MITx/EdX whose well advertised goal is to reach billions of students.

An unfinished revolution in Haiti: the élites versus the masses

Let us begin with the history of Haiti. Haiti's national motto is "L'union fait la force" which means "Unity Makes Strength," evocative of the Haitian Creole proverb "Men anpil, chay pa lou" ("Many hands make the load lighter"). This motto comes from the Haitian Revolution in the 18^{th} century, during which blacks and mulattoes, enslaved and free people came together to show the world that each person, no matter their race and accidents of history, is indeed human and deserves freedom and equality.

In the history of Haiti, from the end of the 18^{th} century onward, there have been a variety of personalities who have fought toward equality for all. We can cite, for example, Toussaint Louverture and Jean-Jacques Dessalines. Nonetheless, inequality still exists in Haiti to this day: the majority of Haitians are still struggling to get by. This was clearly shown in the aftermath of the January 12, 2010 earthquake. The *Boston Globe* spoke frankly about this inequality in an article dated January 31, 2010:

> "The question now is whether the wealthy élite that controls the bulk of the economy will help rebuild Haiti and create a thriving middle class. Eighty percent of Haitians live in poverty, while a handful of often light-skinned descendants of the French, who ruled the country's coffee and sugar slave plantations until Haiti declared independence in 1804, and other groups control most of the wealth."

But it is not only light-skinned Haitians who have placed barriers before the masses. It is among the élites in general—among those who are light-skinned, those who are of darker complexion, wherever their ancestors hailed from—that we continue to find influential Haitians who continue to place barriers before the masses. They consider Haitians who speak only Kreyòl as inferior to Haitians who know how to speak French, and by words and by deeds, they continue imposing French as *the* language for academic and socio-economic success in Haiti.

"An upside-down school in an upside-down country"

Let's look at a brief example of the problems that arise when children who don't speak French are made to learn *in* French, most often with teachers who themselves are not (fully) comfortable in French and most often without any prior systematic opportunities for them to learn French.

The following scenario is one that I witnessed first-hand in 2011 in a public elementary school in La Gonave, in a unit on natural sciences in a third-grade classroom. The teacher wrote on the blackboard this multiple-choice question, in French: « Qu'est-ce qu'un arbre? Les arbres sont des: a) êtres vivants; b) êtres non vivants; c) êtres passedant des pieds. » [*What is a tree? Trees are: a) living beings; b) nonliving beings; c) beings* "passedant" *feet.*]

How did the teacher come up with « êtres passedant des pieds. »? "Passedant" is not a French word. The teacher may have intended to write "possédant" [*possessing*] though he didn't seem to notice the mistake when the word was pointed out to him and he was asked what it meant. And where did "des pieds" [*feet*] come from? And why would he write "possessing feet" as one possible choice alongside "living beings" and "nonliving beings"?

The explanation is simple once we take into account the fact that the teacher is primarily a Kreyòl speaker with limited fluency in French. Whereas in French, they say "un oranger" (*an orange tree)*, in Kreyòl we say "yon pye zoranj." And "pye" in Kreyòl also means "foot/feet." In French, when they say "un bananier" (*a banana/plantain tree*), in Kreyòl we say "yon pye bannann." And the Kreyòl word that corresponds to the French word "arbre" [*tree*] is "pye bwa" (literally: foot wood). So for that teacher, it made sense to ask the students if a "tree" could be defined as something that has feet ("possédant des pieds").

Let us analyze the reaction of a student who responded B to the question. That is, the student picked the answer whereby trees are "êtres non vivants" (i.e., non-living beings). I asked the student, in Kreyòl: "A tree, is it alive or not alive?" The student thought about it, and replied in Kreyòl: "An orange tree produces oranges, it produces leaves, it dies, it grows. So, it's alive!" So the student perfectly understood that a tree is a living thing, and he fully understood what the correct response should be. But why did he write that a tree is a "être non-vivant" (i.e., a non-living being")? In Kreyòl we use the expression "kretyen vivan" (literally "living Christian") to refer to human beings, and to *human* beings only. With that in mind, one can reasonably hypothesize that the student made a connection in his mind between the Kreyòl expression "kretyen vivan" and the French word "vivant"—Kreyòl "vivan" and French "vivant" have the exact same pronunciation. Then the student concluded that, since a tree is not a human being, it's not a *kretyen vivan* (in the Kreyòl sense), and, therefore, not a *vivant* (in his Kreyòl-based interpretation of the French word "vivant"). So he chose the response that was logical to him: a tree is not an "être vivant" given his understanding of the Kreyòl phrase "kretyen vivan" and the French word "vivant." In all likelihood, the student's response was based on his Kreyòl knowledge. Given the one language that he's immersed in (i.e., Kreyòl) it is not surprising that he did not know that in French the word "vivant" can be used to refer to trees as it can be used to refer to human beings and other living things. This is a normal consequence of this child's linguistic and scholastic environments: this student is a child who only speaks Kreyòl at home. He is a child who is living in a community in which the majority of people speak Kreyòl only, a community in which the word "vivan" is used to describe *people*, not trees. And his teachers too have limited knowledge of French.

What do we see here? We see that both the teachers and the students are using the knowledge of the one language they speak fluently (i.e., Kreyòl) to design assignments and to respond to these assignments, even if the assignments themselves are written in French. Such paradoxes have led my friend and colleague Yves Dejean to write his book *Yon lekòl tèt anba, nan yon peyi tèt anba* [*An upside-down school in an upside-down country*], a major book in Kreyòl that analyzes such problems. In this book, Dejean makes two very important remarks that are germane to our reflection. First, when we look at countries that have been independent for more than one hundred years, Haiti is one of the rare countries in which all citizens speak one single language, yet the schools in that country don't use that language as the main language of instruction and examination. This situation has created barriers that impede students' progress, a situation that makes them unable to get a good education.[3] Second, Dejean explains that this "upside-down" use of French in the country blocks the country's development.[4]

Education for all—*really*—and a plan that is truly "operational"

There are already valiant efforts on the way to change the current situation where education is only for the few. The most recent and most talked about effort is the Haitian government's "Programme de Scolarisation Universelle Gratuite et Obligatoire" (PSUGO) started in 2011 toward a free and obligatory universal schooling program. How do these programs fare vis-à-vis the language barrier that has long blocked education for all in Haiti?

Consider, for example, several documents that were written after the 2010 earthquake in Haiti with the goal of diminishing social inequality and promoting Haitian cultural values and heritage through education. In the 2010-2015 Operational Plan, the government announced the goal of "balanced bilingualism" whereby the whole country would eventually become fluent in both French and Kreyòl. But let us recall again the proverb that says, "the Constitution is made of paper, bayonets are made of steel." There's also this saying: "Words and actions are two different things." So let's ask: What has really come out of all those calls to reduce social inequality in Haiti? Given abject poverty levels and other challenges to development in Haiti, how can a country in which more than 90% of people speak only Kreyòl become a country in which everyone speaks two languages fluently?

Unfortunately, despite the Haitian Constitution's eloquent statement (in Article 5) about Kreyòl being the only language that cements all Haitians together, despite all the other eloquent statements in various plans to rebuild the country, despite a long list of eloquent articles on the uses of our national heritage in education, Haitian schools continue to impose French as *the* main

[3] More information on this problem can be found in a UNESCO document: World Data on Education. Haiti : http://www.ibe.unesco.org/fileadmin/user_upload/archive/Countries/WDE/2006/LATIN_AMERICA_and_the_CARIBBEAN/Haiti/Haiti.pdf

[4] Also see Stephen Walter's 2008 article "The language of instruction issue: Framing an empirical perspective" in *Handbook of Educational Linguistics* (Blackwell Publishers, 2008) and Benjamin Hebblethwaite's 2012 "French and underdevlopment, Haitian Creole and devlopment: Educational language policy problems and solutions in Haiti" in *Journal of Pidgin and Creole Languages*, 27.

language of instruction and examination, even when the children do not stand a chance of becoming fluent in French, and even when the professors themselves do not speak French fluently. This is certainly not the right approach to any sort of "balanced bilingualism."

Worse yet, in many places, the students who are taking their "Certificat" exams (to enter secondary school) or their "Baccalauréat" exams (to enter university) don't have access to the Kreyòl versions of these exams. And even when they have access to the exams in Kreyòl, many prefer to take the exam in French, because they have already memorized the corresponding materials in French (typically students do not have access to a full range of books in Kreyòl, and especially not in science and math at the more advanced levels). Very often, the only exam they take in Kreyòl is the exam *on* Kreyòl. For all the other exams, the majority of students complete them in French—often by regurgitating texts in French that they have memorized *by heart*.

Kreyòl-speaking students are still punished and humiliated (they are given a "symbol"[5]) when they speak Kreyòl in school—except in the courses where they are taught about Kreyòl! This is a repressive system that interferes with the skills and creativity of Haitian students, especially those that come to school speaking Kreyòl only. Research shows that among ten children who enter the first grade, only a single one (that is to say, 10%) will finish school.[6] Interestingly, 10% is one of the percentages that have been reported for the proportion of Haitians in Haiti who speak French in addition to Kreyòl.[7] This language barrier is one of the reasons for Haiti's underdevelopment, just as in many other countries in a similar situation—countries where schools do not make systematic use of the language spoken by the population. An educator named Stephen Walter did a large study that showed a strong correlation between undeveloped countries and countries in which the national language is not the principal language of the schools (see notes 3 and 4).

An "Operational Plan" with good tools and methods for teaching science and mathematics

Let us now move from theory to practice. We would like to describe an "MIT-Haiti Initiative" whose objective is to introduce new technologies and new methods for instruction in schools and universities. The rationale for that Initiative started with the work that I began at the Lekòl Kominotè Matènwa ("LKM"), a primary school in Matènwa, La Gonave. At LKM, we have seen how children enjoy mathematics in their own language, with the software we have installed for them.[8] This is not surprising. Scholars who have done in-depth research in education have already shown how active learning helps students to build knowledge. Such active learning—with observation, experimentation, project- and inquiry-based collaborative tasks, etc.—can help students understand and construct complicated concepts. Moreover, when students use a

[5] A "symbol" ("senbòl" in Kreyòl) is a form of public punishment in which students are given a symbolic item (such as a tag to affix on their shirts) to humiliate them if they are caught speaking Kreyòl at school. Teachers often ask students to keep lists of their peers who speak Kreyòl, and these lists are used to give out the "symbols" to the students found in violation of the no-Kreyòl policy. Such forms of repression and public humiliation as punishment exist in many Haitian schools despite ongoing efforts to promote the use of Kreyòl as language of instruction.

[6] *Pour un Pacte National pour l'Éducation en Haïti,* Groupe de Travail sur l'Éducation et la Formation (Port-au-Prince: Bibliothèque Nationale, 2010)

[7] Yves Dejean (2010) "Creole and education in Haiti" in *The Haitian Creole Language: History, Structure, Use, and Education*, edited by Arthur Spears & Carole M. Berotte Joseph (Lexington Books/Rowman & Littlefield, Lanham, MD)

[8] There is a video on YouTube: http://www.youtube.com/watch?v=CU4NuFcK8D0

language they already know to build their knowledge, it allows their ideas to be clearer and their linguistic competence to become even stronger. Such students are able to more comfortably report what they observe, as they develop their scientific hypotheses and test to see if those hypotheses are correct and adequate.[9]

The majority of scientific activities that children should master at school depends on those children's ability to communicate clearly with themselves and with others. For that reason, science and math classes should use the questions, practical experience, observation and experimentation that come from the students' own lives. And the students should use the language that they speak best, so they can explain their ideas and exchange these ideas with others—be it other students like themselves, their teachers or other people in their communities.

In active learning, it's crucial that pedagogical practice be based on concrete experiences, on experimentation and on using the language that is spoken regularly in the students' community. This is a principle that has already been discovered in major research on the role of language in active learning for better education. Furthermore, when we use the mother tongue to build the foundations of knowledge through active-learning methods in reading, writing, science and math, the student will be able to more comfortably and more ably transfer that knowledge to any other language she later learns, be it French, English, Spanish, or another.

This principle has a logical consequence that is also important: If we wish to create a solid system for active learning and for in-depth research and innovation in Haiti, a system that allows all primary and secondary school and university students to become proficient in science and math, we must do it in Kreyòl, and the materials must be written in Kreyòl. In such a system, more students will have the opportunity to become scientists, engineers or mathematicians who are better prepared to tackle and solve their own problems and problems that affect their communities and their country. Without such a system, it is only a tiny handful of Haitians who will continue having access to quality education. This will continue blocking our country's development.

In the pilot project at LKM, we observed how comfortable and happy the children were when doing math with manipulatives and computer games. Manipulatives are pedagogical materials that the students can touch, materials they can manipulate, materials that allow them to build their knowledge while interacting with pedagogical materials, thus, to learn better. At LKM, the students at LKM use manipulatives such as Cuisinaire rods—concrete wooden rods or virtual rods through digital resources. They have access to software tools that make learning mathematics easier, more dynamic and more enjoyable. For example, there is a soccer game in which the children score a goal whenever they get the right answer for a math problem. And the most important part is that the interface to the computer-based activities is all in Kreyòl. But the work doesn't end there...

Notwithstanding our best efforts at the primary-school level, those efforts won't achieve much if the teachers themselves are not comfortable with the active-learning technology in Kreyòl. In the MIT-Haiti Initiative led by Dr. Vijay Kumar (Director, MIT Office of Educational Innovation & Technology[10]) and myself, we are developing tools and methods that use Kreyòl for active learning in science and math in university and secondary schools. These resources can

[9] See, e.g., Webb, P. 2010. "Science Education and Literacy: Imperatives for the Developed and Developing World." Science 328, 448; DOI: 10.1126/science

[10] http://mit.edu/vkumar/www/ , http://oeit.mit.edu

help in the training of teachers, so that they become proficient in the theory and practice of science and mathematics, according to the goals of the 2010–2015 Operational Plan. We have taken software tools in which one can do virtual genetic experiments (for example, on genetic crossing), and we have translated them into Kreyòl. We have done the same with a range of other resources: software tools to visualize proteins, software tools to simulate physics experiments (in electromagnetism, electricity, movement, etc.), software tools to visualize the solutions of certain mathematical equations (for example, differential equations), and so on. We have integrated these tools with other active-learning methods and pedagogical resources, all in Kreyòl.[11]

The university and secondary-school faculty who are participating in this program have explained to us how their students have a great deal of difficulty, even those who speak French, when confronted with problems in biology, physics, or mathematics: very often, they can't solve these problems properly because they are so accustomed to memorization. This is perhaps one reason why there is not yet any major research program in Haiti in any scientific field. When we introduce software tools in Kreyòl for active learning, we see very quickly how teachers and students alike come to understand principles that they had difficulty understanding before that. That is why we are using these new technologies in Kreyòl, so that the students can truly understand what they are learning. The language that students speak at home and in their community is the language that will best help them express their thoughts so they can practice good scientific and mathematical reasoning, so they can apply their knowledge to solve concrete problems in their community and their country.

The Kreyòl-based digital active-learning technology that is being developed by the MIT-Haiti team is completely different from the old system of memorization that exists in Haiti and many other places. When students are learning science and math in a language that they haven't mastered, they have to learn by heart, without deep understanding. The majority of the teachers have learned according to the rote-memorization tradition. This is the reason that we decided to work with faculty who are in the fields of science and math at university. Because it is these universities who should be training the teachers who will teach science and math at all levels—primary school, secondary school and higher education...

There is another important reason that we should conduct science and math in Kreyòl at university in Haiti. According to the United Nations, every person on earth has the right to enjoy the benefits of science.[12] But in Haiti, this has never come to be. The majority of Haitians have never enjoyed the right to adequately study science—that is, they have never had access to science in their own language. The use of French from primary school to university is a barrier to the study and advancement of science in Haiti, it is a barrier to the enjoyment of the benefits of science and its applications, and it is a barrier to the development of the country as well. Before the MIT-Haiti Initiative began, there were no Kreyòl-language online materials for university-level science and mathematics. We have found a remedy for that ill. It is a remedy that uses online Open Education Resources. These resources will help us spread science and math in Kreyòl for free on the Internet—or else on USB drives for remote areas that do not yet have Internet access.

[11] A sample of these resources is available online on the website of the MIT-Haiti Initiative: http://haiti.mit.edu
[12] According to Article 15 of the *International Covenant on Economic, Social and Cultural Rights*. http://www.unhcr.org/refworld/docid/3ae6b36c0.html

We at MIT are collaborating with several partners in Haiti and in the United States. Thanks to this team, the MIT-Haiti Initiative is doing something that has never before been done. As far as we know, this is the first time that Kreyòl-language materials in science and math have been developed for higher education. We are currently at the stage where we are testing the quality of these materials before we try to spread them throughout the country.

So, how did we choose which materials to develop? How did we decide what we would do in Haiti with these active-learning tools? In October 2010, MIT and the Foundation for Knowledge and Liberty ("FOKAL") in Port-au-Prince organized, at MIT, a planning symposium with a group of MIT faculty interested in global education and faculty and education leaders from Haiti who are working to improve higher education in Haiti.[13] What were our goals? We were trying to find the most constructive areas of synergy between MIT's and Haitian universities' respective assets and needs. We organized this symposium in order to plan our collaboration so that MIT and Haiti could each learn from the other and mutually benefit. That is how we decided to develop various sets of Kreyòl-based and technology-enhanced tools and other materials in Kreyòl for active learning in different fields: physical sciences, life sciences and mathematics. All the materials we've produced are completely in Kreyòl, and tools for virtual experimentation, visualization, simulation, and modeling are all in Kreyòl. When we conduct training workshops in Port-au-Prince, all the sessions are translated into Kreyòl. In these workshops, we've observed how the participants are completely and joyfully engaged in the active-learning activities, collaborating and learning from each other—unlike the traditional French-based Haitian classroom experience where only the professor speaks and where students passively copy notes in their notebooks.

Obstacles and Opportunities – "I think, therefore I am."

But, things are not easy. There are great obstacles we must overcome to truly succeed in this project. The first challenge is: How should we create a new vocabulary for science and mathematics in Kreyòl? This vocabulary does not yet exist at the most advanced levels of these fields. It is all of us engaged in this Initiative who are creating the vocabulary as we work on this project. Unfortunately there has never been a national policy that encourages scholars and professors to produce works in Kreyòl. As a consequence, scientific documents in Kreyòl are rare, and those that do exist are often lacking in quality. This is not surprising if we consider that, as compared to the big presses that produce books in French, the small presses working on Kreyòl materials do not get substantial subsidies from the Haitian government or from major donors. But as linguists, we know that a language's vocabulary is like a muscle: vocabulary develops as one uses it. The more one uses it, the larger it gets, and the more strength it will acquire so it can do what we need it to do...

There is another challenge as well: How can we change the habits of the too many faculty and students who have become so steeped in the rote-memorization tradition? We must try to create a new set of habits, a culture of creativity and innovation that promotes active-learning methods in order for the teachers and students to engage in in-depth studies and research in science, mathematics and other subjects in Kreyòl. We are indeed trying to create a set of habits that will allow students to delve as deeply as possible into their academic disciplines.

[13] More details can be found at: http://haiti.mit.edu

We have already taken the first step toward these goals. Our MIT-Haiti Initiative—which includes MIT faculty and staff, faculty and administrators in Haiti and at several partner institutions—have already begun to create math and science materials in Kreyòl, and we have begun to use them in training workshops on high-quality tools and techniques for active learning.

There are many people—intellectuals, policy makers, educators, linguists, parents, etc.—who seem convinced that science and math cannot be done in Kreyòl. They believe that in Haiti it is only French that is sophisticated enough to teach complex concepts. But they seem to have forgotten one important historical fact. If we look back many years, to the time when scholars in Europe wrote mostly in Latin or Greek, no one used the vernacular language of the people to teach or write about science (consider, for example, French in the Middle Ages). A language like French in the Middle Ages, like Kreyòl nowadays, lacked many terms for math and science. In 1637, the French philosopher René Descartes was one of the first scholars to publish their scientific work in French. At that point in time, French was still considered a "vernacular," that is, a "vulgar" and un-sophisticated language as compared to Latin and Greek. Back then, French was such a poorly regarded language that professors would whip students at the Université de Paris for speaking French.

In 1637, when Descartes published his *Discourse on the Method* in French instead of Latin, it was because he wanted to "vulgarize" his scientific methods so that more people in France could learn from his work. That was why he sought to write his book in a language that was as clear as possible, in a language that his compatriots would understand more easily than Latin. He did not wish to share his knowledge with only the small élite of scholars who knew Latin. In the same book in which Descartes presented his beautiful philosophical conclusion "Je pense, donc je suis" ("I think, therefore I am"), he also said:

> "And if I write in French, which is the language of my country, rather than Latin, which is that of my teachers, it is because I hope that those who use only their unalloyed natural reason will be better judges of my opinions than those who swear only by the books of the ancients. And as for those who combine good sense with application, whom alone I wish to have as my judges, I am sure they will not be so partial to Latin that they will refuse to grasp my arguments because I express them in the vulgar tongue." (*René Descartes. A Discourse on the Method of Rightly Conducting One's Reason and of Seeking Truth in the Sciences*.[14])

In Descartes's argument from 1637 about French vs. Latin, we find yet another reason why we Haitians must create our own pedagogical materials in Kreyòl if we want to spread knowledge among the majority of Haitians in our country. This use of Kreyòl will permit students in Haiti to use their "natural reason" and "good sense" to learn, instead of continuing to memorize by heart, with little understanding, texts in French. This use of Kreyòl will also help the language develop a richer vocabulary and sets of conventions so that it can be used, as it should be, in all fields of knowledge. That is how French, too, developed new words for science and other types of knowledge, when scholars began to write in French in the Middle Ages even before Descartes, instead of continuing to write in Latin or Greek. This is why we, in the MIT-Haiti Initiative, are helping prepare a new vocabulary and new tools and methods for science and math education in Kreyòl, a new culture of thinking about higher-level studies in Haiti.

[14] *A new translation by Ian Maclean,* Oxford University Press, 2006, p. 62–63.

This new culture of learning is completely different from the outdated habits that are still being promoted in Haitian schools. Yes, these new methods of learning are completely different from the tradition of rote-memorization of French contents—learning like a mimicking parrot, learning texts and formulas that only a small portion of students can understand well... or badly.

But, for us to truly succeed, we must obtain the cooperation of the following institutions so we can work together to realize the objectives of EFA: the Ministry of National Education, the organizations that finance educational programs, school principals (especially schools where students are still punished for speaking Kreyòl), government offices, courts, NGOs, and so on. These institutions can help us change the old prejudices that exclude Kreyòl from serious matters like science, math, State examinations, administration, justice, etc. We now already have the support and collaboration of many universities, and we've recently secured the support of the Haitian State and its Ministry of Education.[15] So it does seem like the best is yet to come.

In any case, we see the great benefits that our Initiative can create for the future in Haiti and beyond. The first great benefit is for the millions of other people on Earth who speak local languages like Haitian Creole and who need to benefit from the new products of technology-enabled education. There are lots of students among those people who are thirsty for true mastery of science, and who need access to materials in their own languages so they can learn better. Our Initiative will serve as an example for them as well.

This example can also address the question whether a small and poor market such as Haiti can justify the costs of translation. This question touches on the very theme of this LINC meeting: "Education becoming available to all." If the take "all" in its most inclusive sense (to include, say, populations who don't speak English), this goal entails that we must find cost-effective solutions to any problems posed by translation, even as we build local capacity so that technology-enhanced educational resources can be developed right off the bat in local languages, without the extra step of translation from English or other international languages. So our work in the MIT-Haiti Initiative is tracing an example for the positive answer to the question "Will the world take advantage?"—with the assumption that not every student in the world speaks an international language. Furthermore, the costs of a failed education system, with its correlation with under-development, certainly exceed the costs of translation (see notes 3 and 4). The acute-on-chronic failure of Haiti's education system becomes even more of an aberration when we consider the millions of dollars that have been, and are still being poured, by agencies such as the U.S. Agency for International Development, the World Bank, the Inter-American Development Bank, etc.

In a related vein, another benefit is that our project will show how linguists, scientists, educators, engineers, computer scientists, and others can collaborate to tackle on a variety of problems that affect millions of children, millions of students in this world. This is MIT's *Mens et Manus et Mundus* at his best: it shows the way for how new online initiatives such as MITx and EdX can maximize their global outreach to benefit populations that have for far too long fallen on the wrong side of the digital or linguistic divide.

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[15] http://web.mit.edu/newsoffice/2013/mit-haiti-initiative-0417.html
http://tech.mit.edu/V133/N20/haiti.html
http://online.wsj.com/article/PR-CO-20130417-913181.html
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http://www.lenouvelliste.com/article4.php?newsid=115781

Principles and Objectives

We will conclude by saying that our objective is to help develop better teaching methods in Haiti. These methods rest on two central principles:

First: We must use Haitian Creole ("Kreyòl") to make learning truly *active* for Haitian students. Active learning in science and mathematics requires a great deal of reasoning, collaboration and communication. This cannot be done in French or English or any other language that the students do not speak fluently. In Haiti, it is only in Kreyòl that the majority of students can truly participate in active learning.

Second: We use technology to improve STEM education, according to active-learning methods. Thanks to these technologies (for example, a variety of software tools for virtual experimentation, simulation, visualization, modeling, etc., available on the Internet or on USB drives), faculty and students in Haiti will have access to virtual laboratories on their own computers or on the computers of their classmates or colleagues. If there are not enough computers among the students in any particular class, the teacher can use her own computer or the school's computer, with a projector to project the images onto a screen so the whole class can see the experiments being conducted. This will allow the students to conduct experimentation and other practical work properly, so they can learn in greater depth. Such active learning will strengthen their understanding of a variety of complex and abstract concepts.

One of the core ambitions of the MIT-Haiti Initiative is to increase the capacity of higher education in Haiti. Thanks to this project, Haitian faculty will become more knowledgeable in active-learning methodology that is based on new technologies. The teachers who participate in the MIT-Haiti workshops can then spread their new knowledge so that many other teachers and students can learn better—and this has already started with workshops being conducted by faculty at the École Normal Supérieure, Haiti's main teacher-training institution. The eventual goal of these efforts is to establish a large network of pedagogical resources, without barriers, throughout the country, and to have these methods and resources integrated in the country's official curricula—this is one of the main goals of a recent agreement between our MIT-Haiti Initiative Haiti's Ministry of National Education (see note 15). These resources are in Kreyòl, so they can truly be "without barriers"—in a language that the students are completely comfortable in. These types of local efforts—led by Haitian educations in Haiti—will give the project a greater guarantee of having deep and sustainable roots. It is more efficient to develop local resources instead of relying on foreign-based resources only.

This approach (Kreyòl + technology → active learning in science & math → research & innovation) will help us create a smarter Haiti, a Haiti that can lead itself toward sustainable development, a Haiti that can show the rest of the world an example of technology-enabled education made available to "all"—with "all" taken in its most inclusive sense, beyond language barriers. [16]

Only when designers of digital-learning resources start paying due attention to linguistic diversity will we be able to realistically envisage a world where "every young person can have a quality education regardless of his or her place of birth or wealth of parents." Furthermore the MIT-Haiti Initiative has opened up the pool of potential online learners—to students who

[16] Refer to these sites for more details and references about the Initiative and its rationale and history: http://haiti.mit.edu and http://mit.edu/degraff

otherwise would have no access to English-based resources such as those currently available via MITx and EdX. Such efforts will help insure that technology-enabled education can, at least in principle, have truly *global* reach to the extent that it makes it possible for us to reach, and learn from, linguistically and socially diverse groups, thus incorporating diverse ways of learning into our methods for online learning. One welcome consequence is that such an initiative promotes diversity and inclusion with a profound transformative impact for all parties involved. We help educate a diverse world, as we in turn become educated by the diversity of the world we engage in.[17] A win-win proposition!

[17] Iiyoshi, Toru & M. S. Vijay Kumar. 2008. *Opening up education: the collective advancement of education through open technology, open content, and open knowledge*. Cambridge, Mass: MIT Press. http://mitpress.mit.edu/books/opening-education

Finding Ways to Bring Education to Everyone in Panama Through Mobile Learning

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Abstract

This paper presents the main features developed for a mobile learning application to expand the possibilities of learning for students from rural areas or those constrained by schedule and location to attend school. The work presented is focused on methodologies and tool selections to develop the system. Still remains one of the main concerns about the system, which consists on making sure the system is light in terms of power consumption and bandwidth needs.

1. Background

Universidad Tecnologica de Panama (UTP) started a virtual university program back in 2000 with Aulanet, a proprietary platform from a collaboration project with Pontificia Universidad Catolica de Rio de Janeiro (PUC-Rio) in Brazil. By the time, this was the first project of this kind in the country and the main idea was to integrate ICTs (Information and Communication Technologies) in learning and teaching activities in the university along its six branches along the country. According to Clunie, in 2003, UTP, aware of its role and responsibility with Panamanian society and lined up with its vision and mission, created Virtual UTP (UTP virtual) [1], taking advantage of hyper-technologies [2], in response to the needs of specialization and continuous education of people that due to work, schedules, distance, family responsibilities and/or physical despairs did not have possibilities to attend on site education [3].

In 2010 we started a project to design and develop MLEA – mobile learning environment adapter [4], an application to provide a customized access to Moodle in Android based devices. The reason for Moodle and Android laid in the fact in 2008 UTP moved to Moodle platform given the lack of upgrade of Aulanet with new operation systems, and even though by 2010 most smart phones in Panama were Blackberries, the trends worldwide pointed to Android devices.

2. Methodology

For the system design, Service Oriented Architecture (SOA) was implemented. It defines the use of services to support business requirements providing a methodology and a framework for building highly scalable information systems, at the time that offers a clear and well defined way to expose and invocate services, which as a result facilitates interaction among different systems [5], [6].

The client side applies Façade project pattern [6] make communication between screens and the class responsible for invoking web services. On the server side, project pattern DAO [7] is used for web services that make the connection with Moodle database. Also DAO classes are not instanced directly but through a DaoFactory [7] to create instances for each interface connecting to Moodle database.

3. Limitations

Although the scope of the project was to develop an application for mobile learning, we have found the mobile infrastructure in Panama does not cover all the country. Not all the population has access to mobile and wireless infrastructure. Figures show that 95% of the population in Panama has access to mobile networks, but most of this access is limited to 2G and up to 2.5G [8]. Also, since 2008 the government had started a project to deploy public wireless Internet access [9]; however, this project has focused on urban areas rather than in rural areas where there is still many problems reaching technology and so a big digital divide [10]. Therefore, a main issue is creating a light application that can work on 2G and 2.5G, but so far to use all its features MLEA requires either Wi-Fi or 2G and 2.5G, and for some features like localization, even 3G.

4. Mobile Learning System

MLEA, Mobile Learning Environment Adapter, is both an interface that connects with Moodle platform and a native application for Android based mobile devices. Rather than having all Moodle functionalities in the application, there is a set of features that were implemented, based on users preferences [11]. The idea is not to replace the computer as a tool to perform all the learning activities in Moodle, but rather to provide the user with those features they are more compelled to with a mobile device.

A survey was conducted to decide which Moodle features were important to be deployed in a mobile learning scenario. The selected features that resulted were: for synchronous communication – chat, while for asynchronous communication – forums and messaging. Other features include calendar, assignment, short quiz, evaluation, courses, download, and localization. Each of these features have different settings depending on a profile, either student or professor.

Based on the requirements gathered, the client application offers the following functions. Some of which come from Moodle and others from mobile devices´ capabilities.

Synchronous and asynchronous communication tools. These tools refer to the regular real time communication tool – chat, as well as forums and email messaging tools provided by Moodle to allow sharing ideas and opinions asynchronously whenever users have the time to do it. These set of tools do not represent a big weight in terms of computation from the device, can be perform easily with a mobile device, and they represent one of the most important features for a mobile device user.

Agenda. It represents the calendar function provided by Moodle so that users keep updated with the ongoing activities by courses. This feature is useful and attractive for a mobile user.

Grading. It represents the grading feature offered by Moodle so that students and professors can keep track of their performance by course. This feature can be easily accessed by a mobile user and does not require great computation.

Evaluation. This feature is desirable because it allows the professor to check an assignment and give grades as well as students to see them.

Queries.

Download. This feature is highly desirable for a mobile user given the possibilities these devices offer in terms of time management.

Localization. This is not a Moodle feature, but one taking advantage of mobile devices. This feature is only available if the user allows it and can be useful for professor or students to determine aggrupation settings for teamwork.

Statistics. It is a Moodle feature that consists of reports according to specific items. It is available for professor role.

Users. This feature allows user to see which other enrolled student on a particular course is connected in Moodle a particular time.

Courses. This feature allows user to get connected to a course he has already being enrolled.

5. MLEA Architecture

In terms of architecture, MLEA has two sides – the server and the client [12]. The server deploys project pattern DAO using a DAO factory to create the classes with its corresponding interface instances. The client side is the Android application itself. It uses Façade project pattern to make communication between screens and the class responsible for invoking web services.

Each screen in this Android application holds an associated class. This way, for each functionality (i.e. forum, evaluation, courses, messages, chat…) provided there is a group of screens, therefore, a group of Java classes, represented in the architecture by the use of packets.

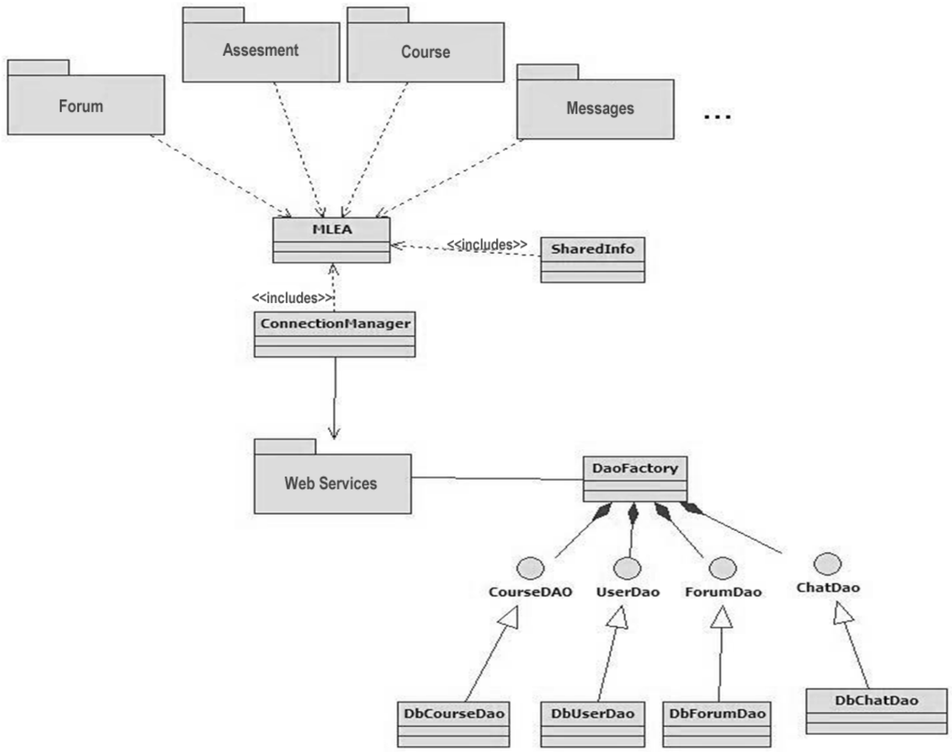

Figure 1. Server View

Figure No.1 illustrates the use of MLEA class that acts in the application like a façade to provide communication between classes and it is used by all the deployed requirements. In this image, it can be seen that the created modules (i.e. Forum, Evaluation, Course, Messages…) are clients of MLEA class, which defines an interface between ConnectionManager and SharedInfo classes, isolating them from the rest of the application. SharedInfo class manages the mobile device´s database, where user information is stored such as authentication, connected users´ ID, and chosen course, likewise cache data. This image shows only some of the modules developed.

6. Results

So far MLEA is in testing phase. As part of the project we have a Moodle server with some courses created for these purposes. However, the tests have been limited to students of our university given that the scope of the project financed by the Secretary of Science, Technology and Innovation was limited to create and test the application, which has been accomplished. Figures 2 and 3 show some screens of the client application.

Figure 2. Logging Screen

Figure 3. Course Selection Screen

7. Conclusion

MLEA includes users view, email, courses, agenda, forums, chat, grading, evaluation, download, statistics, queries, and localization, as the main features considered for mobile learning. The system architecture was designed applying SOA architecture, looking guarantees for a flexible, interoperable, and scalable system. Through the group of web services developed all the functions are achieved. Developing with Façade project pattern in the client side to isolate classes from the rest of the application, as well as using a project pattern DAO factory in the server to create DAO classes also helps achieving flexibility.

8. Future work

Maybe the main concern about a mobile learning system that can guarantee its use, especially in rural areas, is assuring a light application in terms of power consumption and bandwidth needs, given limitations in both aspects nowadays. We expect to address this issue next in coordination with the Ministry of Education in Panama.

Although Universidad Tecnologica de Panama does not have branches in rural areas, it has seven branches along the country in Chiriqui, Bocas del Toro, Veraguas, Azuero, Cocle, and Colon. This represents an opportunity to actually reach rural areas that concentrate elementary and high schools that lack connection to Internet, but some of which have connection to mobile networks [13], [14]. Moreover, our interest in moving forward with MLEA to reach these areas lays in the fact that the government, through the Ministry of Education, has a program “Tecnología para Todos” to provide laptops for children in high schools in the country [15], but so far has only reached urban schools.

9. Acknowledgement

This project is sponsored by the National Secretariat of Science and Technology, SENACYT, as part of the Public Annoucement for I+D International Collaboration. Authors would like to express their gratitude to SENACYT, Universidad Tecnologica de Panama (UTP), and Universidade do Vale dos Sinos (UNISINOS) in Porto Alegre, Brazil for their support on this project.

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CYBERSOCIAL TERRITORIES

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Abstract
This paper is intended to give visibility to the Cybersocial Territories concept, as a model of sustainable and fair regional development that tends to benefit from the SCIENCE, generated by American Universities, and the TECHNOLOGY, generated by Asian Knowledge Industries, to locally develop and assembly INNOVATIVE PRODUCTS. The functional characteristics of a Cybersocial Territory are: 1) It empowers the "Triple helix": State, Academy and Industry; 2) It is sustained by an educational paradigm called Educatronic, and; 3) Uses as, means of interaction and interactivity, the Cybersocial environments.

The model is presented in this document in three sections:
***First**: Evolution of the concept of Cybersocial Territory*
***Second**: Phases for the implementation of Cybersocial Territory*
***Third**: Bases of the educational paradigm called Educatronic*

1. Evolution of the concept: Cybersocial Territories

LatinCampus Corporate University Organization is a Colombian organization that dedicates to scientific research on educational development integrated with TIC's, LatinCampus has dedicated the last few years to the assembly of infrastructure for Digital Territories and educatronic devices; the development of educative content for Globalized and Cibersocial environments and the promotion of the Educatronic and Neuro-educatronic as a model for virtual education. In the achievement of its purpose, LatinCampus has been creating a thinking model, conceived to generate sustainable and fair regional development alternatives, this model, called Cybersocial Territories is characterized by:

1) Benefit regions, cities or Latin-American communities.
2) Leverage on revolutionary SCIENCE generated by American Universities.
3) Leverage on innovative TECHNOLOGY generated by Asian Knowledge Industries.
4) Rely on EDUCATRONIC as means of knowledge generating.
5) Rely on CYBERSOCIAL as means of social interaction and interactivity.
6) Generate and to export local scientific and technological knowledge.

7) Design and assembly INNOVATIVE PRODUCTS.

1.1. Historical Review

Thirty-tree years ago, in 1980, the Time Magazine chose as “Person of the Year” the Personal Computer (PC). Years later, in the Academy it has been thought that this journalistic acknowledgement should be considered the starting point of the Digital Age, establishing a border with the Industrial Age. In the Academy it has also been considered that the Industrial Age was characterized by the atoms-and-molecules management and that the Digital Age is and will be characterized by the bits-and-bytes management.

Countries like Taiwan, Singapore, Finland, India and South Korea, went from being a traditional Agricultural Age country, to becoming potencies in the Digital Age. This leadership in the new age was managed without passing through the Industrial Age, an aspect that has had little divulgation by the economists has an immense economical connotation:

It is possible to become a global economy “skipping” an economic development stage.

Three years ago, in 2010, Time Magazine chose as “Person of the Year” to Mike Zuckerberg, founder of the social networking site Facebook. History repeats itself, but now we can anticipate and declare, without ambiguity that this journalistic acknowledgement will be considered by the academy as the starting point of Cybersociety, characterized as the social-networking management in virtual communities, and as the beginning of new cultural and economic architectures such as Cybersocial Territories.

Which will be the cultures and economies that will lead the Cybersociety?

Can a Society be a world leader in Cybersociety without having being a leader in the Digital Age?

Vastly prognosticated by global economists, the second and third decades of the XXI Century (2010-2029) will be the decades of Latin-America. In this political-economic context the LatinCampus Organization presents to the world’s knowledge society the concept of Cybersocial Territories, as an alternative of sustainable and fair regional development that tends to produce innovative goods and services, empowering the citizen educatronic and cybersocially. Reiterating that in its first stages the scientific knowledge must come from American Universities, and that the Technological knowledge must come from the Asian Industries, until the Cybersocial Territory can generate its own local scientific and technological knowledge.

In this context, LatinCampus no longer ask the questions, but starts giving a concrete answer:

> Latin-American Regions, Cities or Communities can become Cybersocial leaders without being so in the Agricultural Age, or in the Industrial Age, or in the Digital Age. This leadership can be obtained through the implementation of Educatronc-based Cybersocial Territories.

1.2. Conceptual Model

A Cybersocial Territory is a zone; historical, geographical, economic or political (combinable yet not exclusive contexts) that is supported in the generation of scientific and technological knowledge on educatronic environments, and in the interaction and interactivity that is allowed in the cyberspace, to produce innovative goods and services that generate sustainable and fair regional development.

There are four (4) structural aspects that make successful the techno-economic model called Cybersocial Territories:

First: Pertinent idiosyncratic delimitation of the concept of TERRITORY

Second: Leverage on the creation of knowledge in the Cybersocial environments.

Third: Educatronic-based Scientific and Technological Formation.

Fourth: Innovative Products Creation.

A Cybersocial Territory is implemented with the participation and strategic integration of three actors known as the triple-helix: State, Academy and Industry. This model is not novel, High-level American Academy has potentiated the model with evident leadership in MIT and Stanford Universities, novelty is in consolidate its work through cybersocial environments. The actor's roles are:

State: Pertinently legislate to benefit the cybersocial platforms and beings that integrate the Cybersocial Territory.

Academy: Scientifically and technologically educates through the usage of educatronic platforms and environments in the Course of Action of the Cybersocial Territory.

Industry: Globally materialize and makes visible the Course of Action of the Cybersocial Territory, from the innovative products that are designed and produced in the Cybersocial Territory.

Two scenic platforms are required for the assembly of a Cybersocial Territory:

Educatronic: Is the teaching-learning medium for Cybersocial Environments.

Cybersociety: Is the interaction and visibility medium of the Cybersocial Territory.

On this context, a basic definition could be: A Cybersocial Territory is a PRODUCT born with the support of American Universities and Asian Knowledge Industries, operatively leveraged on the Triple Helix (State-Academy-Industry) through educatronic and cybersociety environments with the purpose of generating innovative sustainable and solidary regional development.

2. Phases for the implementation of a Cybersocial Territory

LatinCampus has been studying the implementation of Cybersocial Territories, however, due to the lack of digital infrastructure and regional awareness of the usage of TIC's on economic and educational growth, it has been necessary to start with a "Phase 0", on the implementation of the Cybersocial Territory, which is the construction and implementation of digital infrastructure that takes place simultaneously with Phases 1 and 2 of the Cybersocial Territory implementation (see below).

One of the most interesting examples of the implementation of this model is "Casanare: Cybersocial Territory". Casanare is a department of Colombia, the government of Casanare was interested on the implementation of a Cybersocial Territory. Despite the interest, Casanare is a relatively low developed region of Colombia, and during the evaluation process it was evident that the digital infrastructure was not enough. Casanare had not Internet connection on all the territory, the schools and colleges were not interconnected and there was not a digital culture among the people. Phase 0 was directed, then, to the correction and update of the Territory to a Digital Territory. This problem is generalized on most Latin-American Countries, and therefore most of the following development of the model is purely intellectual and based on future implementation once Latin-America is digitally developed.

The assembly of a Cybersocial Territory – for a region that has already the infrastructure of a Digital Territory (Phase 0) – is implemented in seven phases:

Phase 1. Eligibility Study of the Course of Action.
Phase 2. Socialization and Cultural Awareness (*new paradigm*)
Phase 3. Strategic Alliances / Generation of Scientific Knowledge (technological competitivity)
Phase 4. Strategic Alliances / Generation of Technological Knowledge (technological productivity)
Phase 5. Patents and Intellectual Property (Knowledge Exportation)
Phase 6. Industrial Productivity (innovative products)
Phase 7. E-commerce and Global Positioning. (e-marketing)

Now, for an easier comprehension, we will address every phase starting with a question.

Phase 1. Eligibility Study of the Course of Action.

How to know what must the Cybersocial Territory specialize on?

It must show to the living forces of the region (government, academy, industry, commerce, students, community in general) the alternatives that can be found in scientifically and technologically based PRODUCTS that Latin-America is requiring, and whose knowledge is available in developed countries but has not yet been demanded by our society.

Example: Inmotic-Domotic Devices, Educatronic Devices, Nano-technological Products, Non-military Drones, Academic e-content, etc. It can be counted by milliards the scientific-technological products that could have a local demand and that still are considered prototypes in Universities and Knowledge Industries of developed countries; or that are just not exported by its creators.

Given our "in-situ" experience, LatinCampus' recommendations are: Leverage on US Science, and on Asian Technology, preferable Taiwan, Hong Kong, Seoul and Singapore.

To this date, LatinCampus has studied seven (7) pertinent Courses of Action to develop in Latin-America, and that have the potential to become models of self-sustainable regional development in the Cybersocial Territory context.

Educatronic: Generation of e-learning, e-training and trainer-devices.

Building Automation: Creation of inmotic and domotic products and services.

Bio-mining: Mining exploitation on bio-sustainable and bio-technological environments.

Alternative energy: Devices for the generation and usage of alternative energy sources (solar, wind, hydrogen-based)

Bio-mechatronics: Design and fabrication of bio-controlled artificial prosthesis.

Commercial Drones: Unmanned aerial vehicles for scientific, commercial and social purposes.

Phase 2. Socialization and Cultural Awareness (new paradigm)

How to promote the chosen Course of Action of the Cybersocial Territory?

As long as the society is not aware that a Cybersocial Territory is being implemented, and which is its Course of Action, the project will have a government-only outreach, and it will hardly become a state policy.

> An example to clarify the difference between state policy and government policy: Government is the President and the cabinet members; the State is the Presidency and the Secretaries. Government are people (transitory), State are institutions (permanent).

Through the usage of formative processes with pedagogic, methodological and didactic pertinence, on scientific, technological, technical, socio-cultural environments, it must tend to achieve Mental Involvement of the society in the Cybersocial Territory concept and in the Course of Action. Mental Involvement of all society, but mostly of academic communities trying that they can found in the Cybersocial Territory future development.

The Social Awareness of the economic paradigm of Cybersocial Territories and the internalization of the Course of Action as a development engine are of vital importance for the idiosyncratic sustainability. The formative process must start from secondary education institutions, from the teachers and the parents as well as the other students. The awareness must be present also on the chambers of commerce and the regional industrial gremial associations. The formative process must be taken by the local teachers, scientifically and technologically supported by international lecturers. If the formative process does not gives excellent results on a credibility level, the Cybersocial Territory will be destined to failure on medium or large term.

> South Korea and Taiwan are examples of ICT cultural involvement as a Course of Action, this processes took them no less than 30 years. Colombia, during Dr. Pastrana's administration (1998-2002) tried to become a global ICT potence. Regrettably, due to a lack of notorious results three years after the process started, the project was abandoned, leaving businessman and user-students without a solid policy.

Similar projects to the Cybersocial Territory concept, has been abandoned in almost EVERY COUNTRY in Latin-America. It can even be counted two abandoned projects for country. The main cause for abandonment is the lack of social awareness and mental involvement in the projects.

Phase 3. Strategic Alliances / Generation of Scientific Knowledge (technological competitivity)

How and with who to generate the scientific knowledge required by the Cybersocial Territory?

Latin-American countries don't have the scientific knowledge, or the academic programs that generate the scientific knowledge on the Course of Action that would require a Cybersocial Territory. Consequently, it is necessary to establish strategic alliances between Local Universities and American Universities, to offer academic programs of Master and Doctorate (both with research profiles) on the scientific areas of the Course of Action.

Due to the great costs of bring to Latin-America the scientists that are required to design and to develop the research programs that are required to create the post-graduate programs on the Course of Action, it becomes ineludible the usage of Eduatronic models.

The Strategic Alliance must design dual degree academic programs that aim at generate innovative scientific knowledge, and has as a target, the professionals that will become future local scientists. The only purpose is to turn the city or region in a zone that provides

Scientific Knowledge in the Course of Action. This is the solid base the Cybersocial Territory must be built upon.

Over the first years the local professionals will be beneficiaries of American Science, with time and through formative processes of productive and competitive innovation, those local professionals will be generators of Local Science.

If the local scientist are not generators of their own science – and this must be understood as creators and generators of their own scientific knowledge – the Cybersocial Territory it's condemned to become a Cybercolony.

> It is important to emphasize that the only economically viable and sustainable way to link American Universities with local science formation processes is through high quality educatronic environments. If in the educatronic formation persists the poor quality of local on-site education, and the even worst quality of local virtual education, then the project is ineludibly condemned to failure.

Another important issue is that in times of Information Societies, countries – as a whole – are no longer subject to colonization processes, regions are subject to private industrial cybercolonization.

Phase 4. Strategic Alliances / Generation of Technological Knowledge (technological productivity)

How and with who to generate the technological knowledge required by the Cybersocial Territory?

Just as with scientific knowledge, Latin-American countries do not have technological knowledge or the academic programs on the Course of Action that would require a Cybersocial Territory. Consequently, there is also necessary to establish strategic alliances between Schools and Colleges and the Asian Knowledge Industries to offer technical and technological programs on the construction, implementation and operative maintenance areas of the innovative products of the Course of Action.

The Asian Knowledge Industries that will be more culturally compatible with Latin-American countries would be –among others – Taiwan, Hong Kong, Seoul and Singapore.

The technical and technological programs with double degrees must be offered through educatronic environments. It has as a purpose the generation of qualified labor, and as a target population it has the bachelors and undergraduates of the Cybersocial Territory. The purpose is to turn the region or city into a Specific Technological Knowledge Territory.

Over the first years the bachelors and undergraduates will be beneficiaries of the Asian Technology, with time and through formative processes of productive and competitive innovation, those local bachelors and undergraduates will be generators of Local Technology.

Just as with American Science, the only economically viable and sustainable way to link Asian knowledge Industries with local science formation processes is through high quality educatronic environments. Unlike local Universities a good amount of High School Institutions in Latin-America could be considered qualified by Asian Industries as centers of technological formation.

> An interest thought: North America has the best universities in the world, but a not so high basic and secondary education levels, on some points even below the Latin-American average. On the other side, Latin-America has a relatively high level of

secondary education, but a very low performance on High Education. This must be used as an advantage on the construction of a Cybersocial Territory.

Phase 5. Patents and Intellectual Property (Knowledge Exportation)

Which should be the first exportation product of the Cybersocial Territory?

In the middle-term, the generation of scientific and technological knowledge must conclude with the application form of intellectual and patrimonial property and in the application of patents.

Author Rights and Patents are goods that will allow the establishment of Strategic Alliances with Universities and Knowledge Industries, to offer services of generation of human resources with high socio-economic impact.

This is a good way of transcend in the knowledge society, in which Latin-American societies are not contributors but consumers, partially because of the lack of knowledge of the economic wealth that goes with the information that we possess but don't know how to exploit, certainly we ignore that patents and intellectual property are a great source of wealth and the raw materials of the knowledge society.

On the assembly process of Cybersocial Territories, the first exportation product is the knowledge acquired in the industrial production of the Course of Action. This exportation becomes the exchange of knowledge that potentiates all the actors linked with the development of the scientific and technological knowledge.

Phase 6. Industrial Productivity (innovative products)

When are the levels of employment elevated on the Cybersocial Territory?

The scientific knowledge potentiated by American Universities, and the technological knowledge potentiated by Asian Knowledge Industries must necessarily conclude in the design and generation of Innovative Products.

The Chambers of Commerce and the Gremial Association of Industries, greatly supported by the State and the Academy must promote the creation of Industrial Parks and Digital Micro-cities to develop Innovative Products created from the local scientific and technological knowledge.

Also, the Industrial Parks and Digital Micro-cities will be the leverage of Local Involvement of the innovative products and the Awareness of concepts such as information society, cybersociety, and other socio-cultural tendencies that will potenciate the Involvement on the new idiosyncratic component.

Is in the Industrial Parks and Digital Micro-cities where it will be gestated the true sustainable and solidary regional development that is formed not by a governmental policy, but by a State policy, and that is only potentiated through the strategic alliances with University and Knowledge Industries of high-level digital countries. This development country must be based on Educatronic and Cybersociety.

Phase 7. E-commerce and Global Positioning. (e-marketing)

How to ensure the global positioning of the Cybersocial Territory?

It will be the commercial sector, with the support of the Industrial Park, who, through marketing technologies and product positioning on Cybersocial environments, will take care of globally show the innovative products generated on the Course of Action on the Cybersocial Territory.

It will be also the commercial sector, with the support of the Industrial Park and the State who will generate local events of global transcendence to generate awareness of the existence of Innovative products in fairs, business conferences, and participation of Cybersocial Territory on Science, Technology and Innovation global events.

3. Development of the educational paradigm called EDUCATRONIC

Educatronic is an educational paradigm (paradigm or revolutionary science in the sence of Thomas Kuhn) characterized for implement pedagogical, methodological, didactic and technological solutions and exclusive for Virtual Education environments.

Educatronic deviates from the Virtual Education of the First decade of the XXI Century, as it considers that it is no longer academically sustainable to see virtual education as "ICT-supported traditional-education" or as "Distance education updated with on-line materials". The science and the technology required to implement true virtual solutions it's so specific that it is necessary to contextualize it in global and cibersocial cultural models: Digital Age, Digital Being, Writing-Reading, hypertexts, hypermedia, iconography, dynamic ideography.

The traditional model of virtual education that some universities implemented - more motivated by commercial ends than to empower citizens - has left several bad precedents. To enumerate some of them:

It is a second-class education
It is only for mental learning, there is no instrumental learning.
It has higher chances of fraud by identity theft
It does not form or educate, only inform the student
It has no pertinent evaluation process, only plain questionnaires
It has no pertinent tutors, only e-mail messengers
It is de-humanized, and impersonal.

Besides the government inexperience, the main reason of the initial failure of virtual education was the lack of regulation and accreditation policies of virtual education by the authorities.

However, the model is not bad it has been unfortunately bad implemented in Latin-America, but the model is excellent for natives and digital migrants. To reclaim the model, institutional policies of quality assessment must be implemented, and have to be accompanied by the technological strategies that transcend virtual education to models of revolutionary or paradigm science. In this context, LatinCampus has developed a model of educatronic formation that has paradigmatic components that protect it against deficient educational materials and environments, and against teachers, tutors and monitors decontextualized of the cybersocial model.

3.1 Educatronic Equation

The formation in educatronic environments it can be represented with a simple equation with three components:

Educatronic = e-learning + e-training + training-devices

This equation can be summed up in the following diagram that we will be gradually explaining.

Now, we will make a brief review of each component:

First Component: e-learning

The first component of LatinCampus' Equation is e-learning, whose function is to transmit the theory or educable component of an on-line formation system. It is accomplished through the Pedagogic Mediators, which along with the e-training generate mental or cognitive competences.

The Pedagogic Mediators is a virtual educational material which, pertinently developed, replaces the "teaching class" role of the teacher, this is to transmit information that the student can convert in knowledge. The Pedagogic Mediator allows the teacher to focus on more relevant roles – than "teaching class" – such as being a facilitator of the learning. To pertinently develop a Pedagogic Mediator implies to include pedagogic models, didactic strategies, methodologies and technologies specific for the Digital being and the cybersociety.

There are several didactic characteristics of a Pedagogic Mediator: Hypertextuality, Iconography, Collective Intelligence and Interactivity. Unfortunately these characteristics are obviated due to academic easiness and the need to make virtual education "productive", thus, generating not a formative process (that is valid for on-line environments) but merely informative (intensive web-reading courses).

Second Component: e-training

The second component of the LatinCampus' Educatronic Equation is e-training or digital practice, whose function is to allow the digital practice of the subjects that will be developed with the trainer-devices. The digital practice also generates material or cognitive competences –as the e-learning – but, unlike e-learning, it does so through the Digital Trainer or Expert Systems, that is the software that allows acquiring experience to go to safe real practice.

The e-training is the teachable component of an on-line formation system that generate instrumental competences. Consider that even though is digital, it is not educability but teachability, to understand the difference you must go to interpret the Pedagogic Mediation Concept in the LatinCampus Environment.

The Digital Trainers must be designed in constructivist and construccionist pedagogical, methodological and didactic strategies for it to have value as a formative device and not just informative.

One of the greatest difficulties of educatronic formation is that each of the Trainer Devices requires its own Digital Trainer, making the implementation of educatronic solutions complex and expensive.

The e-training systems have as a purpose to prepare the student to physically approach the Trainer Device reducing the probability to make mistakes that can damage the student or the device, and making the student-device contact highly productive and competitive.

Third component: Trainer-devices.

The third component of the LatinCampus' Educatronic Equation is the Trainer-Device or real-live laboratory, whose function is to allow real practice of the previously digitally-practiced subject. It is accomplished through Educatronic Devices (Didactic Trainers of Artificial-Connected Intelligence).

Trainer-devices are also a teachable component that generates instrumental competences.

On-line Education in most institution is deficient or lacks of practice, which has debilitated the credibility of the education model, and it's the reason why some Universities limit to bring "theory-only" programs to on-line environments.

The Educatronic Devices must "go to the student", just like they do in the e-learning and the e-training, hence the only choice for educatrónica are the mobile or portable laboratories that can "go to the student" wherever he is and whenever he needs it.

A device for training cannot be mistaken for a trainer-device. The first is usually a commercial device that has been acquired for practice guided usually by a teacher or a laboratory auxiliary; Trainer-devices must have the ability to analyze, with Robotic Agents and Artificial Intelligence Agents duly controlled by sensors, how does the student interacts with the device and give positive or negative feedback regarding student/trainer interaction and interactivity.

As an example: driving lessons usually have commercial vehicles that have been lightly modified and a tutor, however, the vehicle is not able to give the student information about how he is driving. An educatronic vehicle should be able, for instance, to take control of the vehicle, regardless the actions of the student, if this is driving too fast or taking a curve to openly, and after correcting the errors, to inform the students of the mistakes made and how to correct them.

3.2 Other environments that benefit the development of Educatronic

Educatronic, as a knowledge society and cybersociety based educational paradigm, needs of special environments that allow the student and the teacher to easily develop the learning/teaching process.

Usual education environments such as Universities, Classrooms, Campuses, etc. do not hold the same importance in Educatronic given that Educatronic is based on de-synchronization and work on multiple spaces.

Added to the costs of implementing Educatronic, has made that many universities and colleges, had opted for a virtual education that becomes more a reading course than real digital education.

To solve this problem LatinCampus has presented several and very diverse Educatronic Solution that has been designed for High Education Institutions, Military Forces and Investigation Centers in Latin-America. In this paper we will not present the most scientific or technological educatronic solutions, but the ones with the highest impact in institutional (and regional) development: The Virtual Campus Node, and the Mobile University.

The information on the approach to these solutions can be found on the LatinCampus Website and most likely will be the subject of future papers presented on these and other academic scenarios.

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Last updated: March 13 of 2013

¿Is a Latin American Common Area of Knowledge Possible? An academic innovation model based on the experience of the Private Technical University of Loja, Ecuador (UTPL)

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Abstract

Today's universities are directly responsible for the production, distribution and transmission of knowledge. For this reason, they are often considered to be vital instruments in trans-national systems. Moreover, the new social, economic and political structures in society demand significant changes in university management. These changes can be summarized as follows: innovation; new mechanisms in knowledge production; improved interaction among universities, enterprises, governments, and society; finance agreements; accreditation systems; training programs adapted to the needs of society; skilled professors and researchers; the usage of Web 2.0; university applied research; accountability strategies, etc. Further, it includes the implementation of a Common Area of Higher Education. Subsequently, Latin America and the Caribbean (LAC) and the European Union (EU) made a joint commitment to participate in the construction of this common area, which is expected to be ready in 2015. The creation of a common area is, indeed, an audacious task. Moreover, if completed, it would signify both a qualitative and quantitative leap in the development of Latin American and Caribbean countries. Therefore, Latin American should be prepared for this change. One way of preparing for this change is to create university models that include a variety of elements, namely those which reflect a quality university in the 21st Century.

Key words

ALCUE, ECTS, UTPL, university credits, training professionals/trainees, university prospective.

Introduction

"The entire object of true education is to make people not merely to do the right things, but to enjoy them; not merely industrious, but to love industry; not merely learned, but to love knowledge; not merely pure, but to love purity; not merely just, but to hunger and thirst after justice"

(John Ruskin/ British Sociologist)

Today we question everything, including the role of universities. We therefore require a true 'Alma Mater' that keeps the quest for knowledge alive. Above all, though, the university should harness its strengths to form pure hearts and minds and establish a commitment with nations, society, and the future. It is a complex task considering the limitations that exist within the sphere of Latin American universities. However, at the same time it is a task that the university has to fulfil on all levels. For this reason, we have taken up the challenge of being part of the development of a Latin American Common Area of Knowledge (ELC) by adopting and adapting a model based on the European credit transfer experience (ECTS). Elements from our own university experience have also been incorporated into this model.

What do we hope to achieve with this model?

a. Achieve academic mobility of students

b. Add value to learning – both inside and outside the classroom

c. Improve reading indexes

d. Empower students in the learning process

e. Change the teacher paradigm: from knowledge source to facilitator

f. Provide training based on professional skills

g. Link students to research incubators and professional practice areas.

1. The ALCUE Common Area of Higher Education (Latin America – The Caribbean-the European Union)

1.1 The European Integration Experience and ECTS

The European Union (EU), which initially had a strong economic focus, fostered the creation of a 'Knowledge Society' by promoting a movement that was geared toward the development of the European Area of Higher Education (EEES). Furthermore, it aimed to achieve the highest level of student training and facilitate their integration into the labour force. At the same time, however, it also enabled the recognition of academic titles. Some of the key action lines that can be mentioned are the student mobility programs (SOCRATES/ ERASMUS)[1] and the Declarations of Sorbonne (1998), Bologna (1999) and Prague (2001)[2].

One of the main problems of European Education has been the lack of effective procedures concerning the recognition of academic studies. This situation has also impeded the development of a real cultural exchange. As a result, there arose a need to find an adequate system for providing academic titles that had their equivalents in other systems. In addition, there was a lack of recognition in terms of academic studies. Consequently, the European System for Credit Accumulation and Credit Transfer was established (ECTS)[3].

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[1] Taken from http://ec.europa.eu/education/programmes/socrates/erasmus/what_es.html

2 Taken from Http://www.mec.es/universidades/eees/index.html

3 Taken from Http://ec.europa.eu/education/programmes/socrates/ects/index_es.html, http://www.aneca.es/modal_eval/docs/doc_conv_aneca2.pdf.

Raffaella Pagani in a Technical Report: European Credit and the Spanish Education System, states that “This system is comprised of a practical code that provides mechanisms to guarantee transparency and facilitate academic recognition via the usage of credits. It also includes the organization of suitable programs; it is based on the volume of work done during the study period”. It consists of a system that is centred on the student, which measures the amount of time that is necessary to fulfil the objectives of the study program. These are specified in terms of learning results and the skills that have been acquired.

The workload required to complete one year of studies at a university under the ECTS system includes professionals presentations; lectures; seminars; practicum (both on and off campus); fieldwork; personal study (library work, work done at home); an end of term project , as well as exams and other means of assessment. ECTS is based on the total volume of a student’s work, but it is not exclusively limited to the number of contact hours taught

1.2 An Overview of Ibero-American Integration

The UNESCO World Conference on Higher Education (1998) and the Summits of the Americas (1998, 2001) are events that repeatedly refer to education as the spinal cord of development for our countries. With this in mind, it has been observed that the quality of teaching and research in developed countries has been growing in relation to the least developed countries. During the 1999 Rio de Janeiro Heads of State Conference that was assisted by representatives from Latin America, the Caribbean and the European Union, an initiative was set up for the creation of the ALCUE Common Area of Higher Education. This project sought to create a platform for interaction and to facilitate bilateral and multilateral collaboration among various Higher Education systems. Within the context of ALCUE, Higher Education is seen as a public good that is essential for human, social and technological development. In addition, it is considered essential for overcoming inequality among peoples, educational institutions and national societies. It also facilitates the process of inter-dependence.[4] It is therefore considered important for university governors to cooperate and participate in the construction of this common area. Moreover, it will foster social exchange between countries and contribute towards a more equitable development within society, especially on a global level.

Another important consideration is the creation of the Ibero-American Common Area of Knowledge (EIC in Spanish). The EIC has been mentioned in several recommendations and mandates of various Ibero-American collaboration documents over the years. In fact, it has existed since 1990. The collaboration documents in which it has been referred to include declarations from the Summits of Heads of State and Government that were held in Bariloche (1995), Panama (2000) and Lima (2001. Moreover, in 2005 a commitment was made towards the creation of the Ibero-American Common Area of Knowledge (EIC) in Salamanca, Spain. During the Ibero-American Summit of Heads of State and Government, which was held on November 5, 2006, the Declaration of Montevideo was signed. This document, which highlights the development of the EIC, states that the Ibero-American Area of Common Knowledge is “geared towards the required transformation of Higher Education and is centred

[4] Taken from http://www.alcue.net/uealc/portal/main/

on research, development and innovation"[5].The signing of this document subsequently motivated Ibero-American leaders to create an academic mobility system for professors and university students. Moreover, it was to be based on the European experience, namely the European Common Area of Higher Education (EEES).

Within this context, we have developed an academic management model that responds to the expectations of the Ibero-American Summit of Leaders. Above all, though, it is a straight-forward, uncomplicated and real response to society's needs in general. Moreover, it can facilitate the creation of university models in Latin America, namely where teaching translates into learning for students (those who are planning to join the workforce), and where countries with a skilled labour force have full time professors with doctoral training experience. In addition, the model includes research of basic problems in society, thus providing solutions to real-life problems. Finally, university extension is reflected in job offers, which is a direct result of the various types of business incubators that have been created.

2. Ecuador's Contribution to the construction of the Alcue Common Area of Higher Education

2.1 The Current Situation of Higher Education in Ecuador

As we have mentioned in our previous work, Higher Education processes in Ecuador are traditionally known for being more centred on teaching than on learning, where the student takes on a passive role in his or her training. In the traditional model, the student is a spectator in the learning process and does not always grasp new concepts easily. As a result, the student has very little interaction with science outside the classroom.

One of the main characteristics of the national and Latin American university reality has been the difficulty in recognizing academic studies and academic titles (Romero Luis, 2011). Universities design their academic programs in such a way that that their international recognition is impossible not only on an international level, but also on a national level too. The lack of confidence in the quality of Higher Education, the arrival of new universities, new academic offers and new titles have led to a situation where academic immobility has been stifled. Indeed, there are very few Ecuadorian and Latin American universities whose students can continue their training at an international university without going through arduous and long processes of academic convalidation. In light of this reality, we should, according to the Declaration of Montevideo, "view" experiences such as that of Europe.

The creation of the Euro-Latin American Common Area of Higher Education is directly related with the commitment of Higher Education institutions in the region, that is, in adopting and adapting the ECTS European experience using a common system for the

[5] Taken from XVI Cumbre Iberoamericana, Montevideo, 2006. www.xvicumbre.org.uy

accumulation and transfer of academic credits, i.e. for Higher Education Institutes from Latin America and the Caribbean (SICA_ALC)[6].

Each country will develop the relevant legislation via its institutions. In the case of Ecuador, it is CES (National Board of Higher Education). This higher education body is responsible for developing a proposal for regulations in accordance with the signed agreements in the Ibero-American Summit of Leaders. However, one should always keep in mind that the recognition of academic studies and titles is a first step in achieving the Ibero-American Common Area of Knowledge.

The success of this initiative will depend on the way in which we develop university management models, i.e. by demonstrating that it can be done within the time frame and within the set conditions and budgets of the universities.

2.2 UTPL's Academic Model

As a Catholic University, the Private Technical University of Loja bases its educational philosophy on the principles of Christian Humanism and the rights of man. Its academic model is centred on training not only professionals, but also individuals – so that they may have a well-rounded education in core values, give back to society, and live happy, fulfilled lives.

Based on this model, we aim to contribute to a more just society, by providing equal opportunities for everyone. We earnestly seek to train students who are capable of developing a vision for the future, who have both an excellent team spirit and an aptitude for leadership and management. Their flexibility and Socratic humility will thus enable them to succeed as professionals.

We therefore wish to support the construction of the Common Area of Ibero-American Knowledge and also form part of the ALCUE Common Area, by presenting our institutional proposal. This proposal is fundamentally based on three key strategic aims:

The consolidation of our academic and research models, thus adding value to the activities that we carry out as a university. We aim to prepare students for autonomous learning, i.e. where the professor manages a student's development by forming skilled, critical and creative students who are responsible for their self-development.

The management of flexible curricula that are based on key skills. These skills integrate knowledge, abilities and aptitudes that the student has acquired in and outside the classroom.

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[6] Taken from 6x4 UEALC project, www.6x4uealc.org

Strategic positioning in a globalized context - thus maximizing the potential of: an inter-disciplinary ethos, usage of foreign languages; teacher and student mobility; and the management of shared accreditation systems.

UTPL offers training that is centred on skills, i.e. using the Tuning project as a reference[7]. The training programs include generalized contents, i.e. where the teachers' efforts contribute to an improved and multidisciplinary HE, thereby leaving open the possibility of postgraduate training. This last stage is where the students' academic and research activity becomes more specialized.

To add value to the activities done by students, namely acquiring and developing the necessary skills for their professional development, it was decided that we should base our model on the ECTS credit system. We coined the term UTPL-ECTS credit to define the unit of measurement of a student's work in and outside the classroom, which is equivalent to 30 hours. Included in this figure are the hours worked outside class, such as attendance at off-site seminars, personal study, exam preparation, exam sittings, productive management activities, academic stays, extra practicum, laboratory practice, research work, and the usage of virtual learning tools and so on. Our training programs provide 300 credits, which include an average of 30 credits per semester, and approximately 45 hours of study time per week.

Teaching Innovation Tools

Our model includes:

Teaching Plan for the Course: This is like a map for the course; it reflects the general guidelines that will be used to teach the course. It is designed according to the student's needs. In other words, the student is the protagonist of his/her learning. In the teacher's guide, you can find specific themes such as the objectives, skills, contents, activities, as well as the methodology that is to be used. With this plan, the teacher is able to structure the contents of the course and plan the estimated time of the activities in and outside the classroom. In addition, it sets out the indicators and the continuous evaluation percentages for the course. For this reason, it is considered an indispensable work tool both for students and professors.

The Virtual Learning Environment: This is where the student-professor-knowledge-technology link is established. Ever since UTPL implemented the Virtual Learning Environment (EVA in Spanish) as technological support, it has been able to compete in quality education. Its results are directly related to the usage of various tools from this technological platform. EVA is used as a virtual platform that is linked to real teaching; it is a tool that enables professors and students to recreate the learning experience.

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[7] Taken from Http://tuning.unideusto.org/tuningal/, http://ec.europa.eu/education/policies/educ/tuning/tuning_es.html

Each subject has its own virtual classroom: This enables professors to provide students with academic assistance, extra tuition, and also send assignments electronically and share information. All our students have access to this electronic tool. They can use the EVA to obtain information about their course and also view their grades. In addition, they can keep in regular contact with their professors.

Free Study Period: These are specific periods during the week that have been set aside for activities such as seminars, conferences, fieldwork, etc. During the course of the academic cycle, academic directors, professors and students may exchange information and resolve queries, i.e. with the aim of maintaining ongoing contact.

Basic Text Book: This is considered an indispensable tool in that the student can become the protagonist of his/her learning. Since the September 07- February 08 academic cycle, UTPL has taken on the responsibility of providing all students with the bibliographical material that is required for their course.

Personalized Tutoring System: Considered a support element in the learning process. In this way, the professors may provide students with direct help in developing skills, and also help improve their academic performance. Furthermore, with the tutoring system, personalized guidance is provided, which helps with their integral training. All UTPL professors are responsible for holding weekly tutorials. This depends, however, on the number of credits they have to teach. By establishing direct communication, students can improve their skills, work on their weaknesses and receive assistance in taking important decisions that affect their professional development.

Web 2.0 Academic Use: The importance of this new philosophy is rooted in the belief that we have everything we need to share our information, experience, knowledge with others (1.100 million users connected to the Internet). The aim is to achieve combined creativity, collective intelligence, and form more established robust and solid participation architecture with respect to our chosen field of science.

By maximizing the usage of ICTs, we are able to enrich our experiences of the teaching and learning process. Knowledge Management was created at UTPL with the aim of developing and supporting a university environment, namely to share and create knowledge for the benefit of our society. All our professors receive permanent training concerning the usage of the tools available on the Web such as blogs, wikis, slideshare, YouTube, del.icious.us etc. In sum, the entire teaching community is beginning to use these tools and is able to interact with each other, and enjoy the benefits of Web 2.0.

Linking students with research incubators and professional practice areas this implies linking professors and students within contexts other than the traditional classroom. In practical terms, it means establishing closer ties with applied research and developing relationships with the student's professional environment.

Leadership Issues for the University Professor

The UTPL-ECTS academic module implies a conceptual change that affects both professors and students. As a Catholic university, our aim is to establish real university professor leadership. This is the reason why we work with professionals that have the difficult challenge of being facilitators of knowledge. These are the people whose commitment, honesty, responsibility, team work and other values contribute to the "training and development of man through science, so that he may serve society". A professor who manages the learning process acts as a kind of student assistant. In addition, he or she guides the student trainee in improving skills that aid their professional self-development.

The professor does not repeat course contents; he or she is responsible for developing a professional student's aptitudes, skills and abilities. One should remember that university students should learn how to learn, and that professors should guide the student's learning process.

At present, there are approximately 180 UTPL students who are taking doctoral courses at foreign universities. Below are some examples of the universities with which we have formed collaborative linkages:

The Polytechnic of Madrid: Alcalá de Henares University; Antonio de Lebrija University; the University of Cordova; The National Distance Education University of Spain; Granada University; the Open University of Catalonia; the University of Tubingen; the University of Dresden, and so on. Having a critical mass of researchers not only facilitates the development of science, but also increases relationships with internationally recognized research teams. Moreover, it helps to develop a teaching role that is based on the actual training experience of the professors as opposed to simply providing a bibliography of references. It is also an opportunity to elaborate a research culture that involves professors, students and society.

Production Management: Linking theory with practice

The UTPL model, which is based on Production Management, is a transversal aim of the university curriculum that revolves around three basic functions of the university: teaching, research and extension. A major part of these activities is carried out at research incubators which we call CITTES (Research, Technology Transfer, Extension and Service Centres). This is where students and professors work on real-life projects. We are convinced that our students will be able to integrate into the workforce as a result of doing these projects. For this reason, teaching the business world with only a whiteboard will not suffice in the long-run. Learning goes hand in hand with hands-on practice. For example, our engineering systems students do not obtain the necessary skills to develop software in the classroom. Our students carry out their practicum, which are known as Production Management, at the Information System and Project Units (CITTES-UPSI). It is here that various professors form a team of professionals and develop software for external organizations. In addition, there is a rota of activities in departments such as software development, technical support, networks and telecommunications etc.

FIGURA 1: Modelo Académico UTPL

The CITTES are equivalent to what in many universities are called departments, laboratories and institutes. In general, these are inter-faculty departments and are defined by topic or field of knowledge. However, in the case of CITTES, the relationship with the environment/ society is a major consideration. Furthermore, applied research is also an important factor in this process. As a result, the transfer of science and technology via extension and service activities is made more viable. In the same way, students can participate in real projects by means of applied research and also help solve real problems in society. When the student has completed his or her academic studies, he or she graduates with having gained direct and practical experience in his/her chosen field.[8]

3. Conclusions

We cannot be a university tomorrow, if we are not a university today. For this reason, we are faced with a major challenge (Delors, 1996). The challenge is to maximize our knowledge of science and solve its key problems. This can be achieved by stimulating the intellectual curiosity of our students and professors, namely those whom we should impart critical thinking skills. This should enable them to discover different options when solving problems. Furthermore, by developing an individual sense of judgement, they are able to fulfil the ultimate aims of higher education, namely those which gave rise to the origin of the university: to seek truth and form man by means of science, so that he may serve society. In our particular case, this vision comes from Christian Humanism.

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[8] For further information about research incubators and collaborative doctoral programs, please visit the following website: www.oui-iohe.org/encuentroincubadoras2008

The joint responsibility of the entire university community in this process enables us to reflect on the contribution that each subject has made to global profile of degree titles. What's more, it encourages us to analyze a student's work in relation with the actual time that is available. Further, it is an incentive to work with a common vision that is centred on the convergence of Euro-Latin American Higher Education. Our model is a major challenge as an institution.

We believe that Latin America, Ecuador and the Private Technical University of Loja are currently facing a social and cultural change. Universities should be aware of the challenge, and carry out their teaching and research duties within a new framework- i.e. where the harmonious development of a Common Area of Euro-Latin American Education is a possibility for the future, and where each student is responsible for building his/her future.

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The Management of the International Online Distance Learning Program in Thailand

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Abstract
Online learning is popular throughout the world however the organization of online distance learning in Thailand does not reach the star. This research project aimed to investigate the situation in the management of online distance learning in Thailand with the focus on international programs which use English as the medium of teaching. Face-to-face interviews were performed with personnel involved in the management of international online distance learning program at Assumption University which is one of the two universities in Thailand that offer international online distance learning programs. The informants included the founder, administrators, teachers and staff of the Graduate School of e-Learning at Assumption University. The themes elicited were quality, acceptance and recognition, and teaching and learning styles. There were some difficulties regarding the three themes which obstruct the development of international online distance learning programs in Thailand.

Key words: online distance learning, Thailand, Southeast Asia, teaching and learning, management of programs

Introduction

Online learning is popular throughout the world. However, in Thailand, the success rate is still low. Although many universities in Thailand offer some sorts of online learning programs, there are only two universities that offer international programs online, Ramkhamhaeng and Assumption Universities. There are success stories and failure stories of online programs in Thailand. This study aimed to investigate the perceptions of the administrators and personnel regarding the problems and obstructions in the organization of international online distance learning programs in Thailand.

The Institute of Education Sciences reported a large number of students were taking distance education courses [1]. About one-third of students in higher education in the US are taking online courses and 65% of higher education institutions reported that online learning is a critical part of their long-term strategy [2]. Online distance learning is popular in the US as reflected by the growing numbers of enrollments and programs offered by tertiary education institutions in the US. The US is leading the world regarding online courses and systems [3]. However, while online distance learning is popular, its effectiveness was still remained questionable. It was found that 70% of students in online courses did not finish the courses [4].

Thailand has been taking the trend in technology development and developing the ICT infrastructure. Higher education institutions take the advantage of ICT infrastructure to promote accessibility to tertiary education for people throughout the country [5]. Unfortunately, several attempts of international universities to offer international online distance learning programs in Thailand did not work out as expected. The context is likely to have an important influence on the success of international online distance learning in Thailand. [6] reported that culture affected students' attitude towards online education and hence their motivation to study. The context of online distance learning in the Southeast Asia is rather different from the US. People in the developed countries are generally more proactive, IT literate, and individualistic while people in Southeast Asia, except Singapore, are generally more passive and collectivistic [7]. It is very likely that cultural difference plays an important part for the success or failure of online distance learning programs. Furthermore, [8][9] suggested that higher education systems in Southeast Asia have various limitations such as budget, quality and standards of education, faculty satisfaction and social demands.

The traditional teaching pedagogy in Thailand was teacher-centered [10]. Students prefer teachers to transmit information or knowledge to them. Students were accustomed to be passive learners. On the contrary, the online distance learning is structure on the student-centered premise. Students are responsible for their own learning [11]. Teachers act as facilitators or mentors in the online distance learning environment [12]. The perspective towards teaching and learning might hinder the organization of distance learning programs in Thailand.

The international higher education online learning programs in Thailand

As of 2012, there were 79 public and 71 private higher education institutions and 19 community colleges in Thailand [13]. Most of them have established some sorts of online learning system and have policies to develop their systems further [14]. The first university in Thailand that offered formal distance learning program was Ramkhamhaeng University (RU) in 1971 [15]. Sukhothai Thammathirat Open

University (STOU) was established in 1978 as the first distance learning university in Southeast Asia that offers only distance learning programs [16] while Ramkhamhaeng University offers both distance and classroom-based learning [17]. All except two universities offer distance learning only in Thai. The Office of the Higher Education Commission (OHEC) approved international online programs of only two universities in Thailand. In these universities, there are 6 programs accredited by the Office of the National Education Standards and Quality Assessment (ONESQA) [18]. All of them are graduate programs.

At the time of this study, Ramkhamhaeng and Assumption Universities were the two universities that offer online international programs (in English). Ramkhamhaeng University (a public university) offered one online program which is the online MBA program. Assumption University's (a private university) offered 5 accredited programs. These programs were Master of Science in ICT - M.Sc. (ICT); Master of Science in Management - M.Sc. (Management); Master of Education - M.Ed. (Teaching & Technology), Ph.D. (Teaching & Technology) and Ph.D. in e Learning Methodology (eLM) [19]. The programs have students from various countries including Asians and westerners.

Methodology

This study examined the perceptions of the administrators and personnel regarding the organization of international program online distance learning in Thailand. The personnel involved in online distance learning programs in Ramkhamhaeng University and Assumption University were approached. Unfortunately, personnel at Ramkhamhaeng University were busy organizing the commencement ceremony where students from all over the countries showed up. They declined the requests for data collection. Hence, this research study included only personnel of Assumption University. The informants included the person who established the online distance learning school, the five directors of the five programs, instructors teaching for the programs as well as some selected staff who handle the learning supports. Face-to-face interviews were performed with all informants in order to elicit their opinions regarding the problems and obstructions in the execution of their programs as well as the teaching and learning process. Each interview lasted approximately 20 minutes. The information was compiled and themes were drawn.

Results and discussion

Several issues emerged from the interviews. Most personnel agreed in the same direction regarding these issues. Some comments on students other than Thais also were derived, hence, at some points the researcher used the term Asian rather than Thai students especially when compared with students in the west. These issues are as follow.

Quality

The key issues were in the responsibilities and accountabilities in offering a quality program of study. Courses were normally compressed into a few weeks which might compromise the quality of the programs. Furthermore, some instructors prefer only asymmetrical communication while, in some cases, instantaneous communication would provide better results. In addition, online learning at home lacked learning and support facilities for research or infrastructures of a good educational environment. Group works could hardly be performed. The interactions, learning, sharing and reflections were minimal. There were also the organizational issues of the negligent of the management from a long distance. There should be clear standards ratings in all aspects such as the curriculum, teachers, materials used for teaching, courseware, the quality of examinations with feedback provided to the institutions offering such programs. There were little trainings of key personnel to handle the systems.

Acceptance and recognition

The Thai government's policy and standards are designed towards classroom-based programs. The government is using the criteria for classroom-based with online system. Some of the policies are not compatible with distance learning. For example, there is a requirement for program of study to have certain facilities such as library, study rooms and etc. in order to be accredited. Students in other country such as Dubai might find it difficult to come to the main campus' library or they might be disadvantaged in this regard. The management of the online programs found many requirements make little sense and unpractical for the online programs. For example, the government insisted that students must be present individually and there must be proctors for final examination. Take home exams shall not be accredited. This has been creating problems for both the school and the students. Some students chose online programs, from the first place, because of their difficulty in travelling to school, for some reasons, but now they have to come for the examinations. On the school side, examination facilities and proctors must be recruited in other countries which incur costs and other formalities. In short, the government lacks the understanding regarding online programs and views online program with the mindset of traditional educators. This mindset obstructs the management of online learning programs in Thailand.

While in countries such as Malaysia and Singapore, online programs are accredited and accepted by the public, in Thailand the public views online programs skeptically. The lack of knowledge and understanding about the online learning causes the majority of the policy makers and employers to view the online degree program in a negative direction. There are problems of prejudice toward the online learning and students who graduated from the online program. Parents prefer their children to attend classes rather than studying at home. Employers do not view students graduated from online learning programs well.

Teaching and learning styles

The online learning in Southeast Asian countries should be delivered in the similar fashion as in other countries around the world because online learning is accessible to all. The online learning in Southeast Asian countries should be developed in a way that it is accessible to others as well. However, the nature of distance learning is different from the traditional approach. Asian students were mostly not constructivists. While the distance learning program students should construct knowledge facilitated by instructors, students in Thailand were more traditional, i.e. rather passive. The teaching style might not correspond to the preferred learning styles. In general, their learning preference at tertiary level could be predicated on the way they had been learning earlier in the past (primary and secondary schools and even colleges). Rote learning had been ingrained in them and indeed their teachers and lecturers that the whole system was predominantly rote-learning. So logically, students doing distance learning would also expect to have rote learning as their primary learning or delivery style. Rote learning is difficult to organize in distance learning programs. In the west, generally, the teaching even at primary school level, is already espousing independence of thoughts. Thus, by the time the students get to the university level, they are already "trained" to be thinking critically. These students are therefore able to be left alone and carry out the learning critically and independently. That would be ideal in the distance learning setting. In distance learning Thai students' independence could create problems for them as they would not know what to do. It is important that the students are self-motivated and have the persistence to stick it out in case of difficulties, rather than giving up.

While the students in the West are used to reading, their Asian counterparts hardly spent anytime reading. Whether the delivery system of learning is on-line or through the post, students who are not already competent in reading and English will flounder.

The mode of study, the way the lecture presented, the way students are working on the activities should be a freedom of the instructor. The Southeast Asian countries could benefit from the diversity of classes and nature of the online learning instead of having everything standardized and controlled in such a way that there is no uniqueness of institutions or countries that offered the course.

An understanding of the students (as a class and as individuals) by the lecturer or module writer is mandatory. This would include finding out the students' demography, generation, reasons for doing distance learning, their previous learning methods, exposure to more modern learning methods, independent learning, reading skills, writing and expressions skills, English language competency (practical not just theoretical) and last but certainly not least critical thinking skills. An important question to address is how distance learning could incorporate the collectivistic nature of Asian students.

Accessibility to local assistance should be provided so that the learning is not going to be interrupted by difficulties in understanding the material, the problems they have to solve so that the interactive mode is practically achieved. An effective communication system should be established for students to interact with each other instantly.

Conclusion

In order for online learning to be successful, the education paradigm should be shifted. There should really be no difference between the West and Asia in respect of distance learning organization but their implementations would need a very good and careful look. There are many newer learning and delivery methods that lecturers and program developers must take into account. Unless the distance learning program developers and executors are aware of the various investigations into generational gaps and novel teaching and learning methods, the distance learning program will not be successful.

In Thailand, a blended version as opposed to a full fledged online is preferred. Asian students needs more rapports and communications (face to face) to learn and share, and especially that Thai students are not independent or self-motivated or has much self initiatives as opposed to Western students who are more independent and responsible in managing their own work with more self-responsibility. As such, Thai distance learning should be a more blended, have more face-to-face rapport and communications with more group works than individual work. Though students might claim to prefer long distance, most of them worked better with a blended version with direct contact and sharing with lecturers and friends. Students prefer to control their own learning pace as well as having the instructor or facilitator to interact with them either asynchronous (discussion board or e-mail) or synchronously (skype or video conference). Students in the online learning environment where the instructors actively engaged with them were more engaged with class activities.

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The Students' Perceptions toward Ramkhamhaeng University Blended Distance Learning

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Abstract

This qualitative research paper aimed to investigate graduate students' perceptions regarding Ramkhamhaeng University's blended learning practices which included face-to-face, eLearning, as well as other tools in the distance teaching and learning process. Focus group interviews were conducted with graduate students in regional campuses where distance learning was organized. Results revealed that most students prefer distance learning with blended tools. They perceived that blended learning led to social equalization, interactivity, flexibility, dynamic materials, interesting presentation, and motivation to the society and the students.

Key word: blended learning, e-Learning, Thai culture, distance learning, face-to-face learning

Introduction

The Information Technology (IT) has a strategic impact upon organizations and the society [1]. Traditional long distance learning was performed through traditional media such as mail, radio, television broadcasting, and etc. Nowadays, class content can be delivered through the internet system which creates a new form of distance learning. It was estimated that at least 80 percent of business schools in the US now offers online program for students [2]. The internet has been adopted by people around the world. North America had the highest internet penetration rate as a percentage of population at 78.6% followed by Oceania/Australia at 67.6%, Europe at 63.2%, Latin America/Caribbean at 42.9%, Middle East 40.2%, Asia at 27.5% and Africa at 15.6% [3]. Although the penetration percentage in Asia was on the low side, Asia had the largest number of population who used the internet with 1,076.7m users or about 4 times more than North America (273.8m). Within Asia, unsurprisingly, China led the group with 538m users followed by India, Japan, Indonesia, South Korea, Philippines, Vietnam, Pakistan, Thailand, and Malaysia. Thailand ranked number 9 in Asia with 20,100,000 internet users (30.0%) among which 17,721,480 were facebook subscribers [4]. The internet has provided access to education to a large number of people and helps to create a knowledge-based economy [5].

Online distance learning

Students in the modern world were born into a digital world and they were internet literate [6]. Many educational institutions have adopted online teaching as an effective tool in the teaching and learning process for children in the net generation [7][8][9]. Online learning was adopted as one of the sustainable strategic movement for educational institutions [10]. Furthermore, online technology was used in various functions such as to process the admissions, enrollments, communication, as well as to share knowledge [11]. Distance learning offers more benefits than disadvantages [12]. Some of the advantages included time and distance convenience, fast feedback, students' control over their paces of learning, opportunities to review the teaching process, teachers and students' interaction, and accessibility [13]. Learners have the opportunity to absorb knowledge distributed in different forms and by different people, thus increase their confidence and independence [14]. [15] found that online students performed better than classroom-based students. On the contrary [16] reported from a meta-analysis that students having online instruction performed modestly better than students having only face-to-face learning and that blended learning was found to be more effective than either face-to-face or online learning alone. The literature showed conflicting findings regarding the students' satisfaction in e-learning. For example [17][18][19] reported positive results while [20][21] reported negative students' satisfaction toward e-learning.

Blended online teaching-learning process

[22] suggested the role performed by instructors is important in determining the quality of the class. Their roles influence the success of the learning process and quality of students' experience in the classroom [23][24]. Teachers should encourage class discussion and involvement through teacher-student interactions [25]. [26] found a large proportion of faculty reported that face-to-face classes were more effective than online classes alone. Teachers' beliefs influence the ways they teach [27]. [28] concluded that negative opinions regarding online technology could prevent teachers from utilizing the IT to its potentials. [29] Many teachers resisted new technology [29]. [30] elaborated that teachers' resistance to technology included the resistance to intervention, organizational change, time management problems, lack of support, negative perceptions, and psychological factors. Teaching online should be different from face-to-face since the two modes are different. [31] has suggested that online learning is more than simply uploading the teaching materials and classroom interaction on a website. On the students' part, learners are different in their learning styles, directions and potentials [32]. [33] suggested that students' learning is dependent upon the students' inquiry process. They have different learning styles [34].

Online students should be self-motivated, patience and can manage their time and communications with others [35]. [36] suggested that attitudes towards online learning, learning style or preferences, time management, interpersonal skills, technical skills, and instructional designs could obstruct the online teaching-learning process. [37] suggested the advantages of blended learning system were: pedagogical richness, access to knowledge, social interaction, personal agency to suit various learning styles, cost-effectiveness, and ease of revision.

Online education in Thailand

The Thai government has been trying to create infrastructure to facilitate institutional Knowledge Management (KM) and life-long learning in order that the Thai society would move towards the knowledge-based society. In relation to education, the government has been supporting the application of computer technology in education institutions. Table 1 illustrates the number of IT users in Thailand classified by age group out of approximately 63m population.

Table 1. *Number* of IT users in Thailand classified by age group

Age group	Computer users	Internet users	Mobile phone users
6-10	2,922,709	1,316,168	527,764
11-14	3,501,312	2,653,986	1,842,028
15 - 19	3,887,988	3,702,497	4,394,143
20 - 24	2,270,724	1,960,948	4,590,931
25 - 29	1,970,207	1,651,566	4,614,384
30 - 34	1,791,704	1,499,523	4,595,033
35 - 39	1,394,684	1,145,505	4,641,357
40 - 49	2,051,371	1,650,320	8,855,395
50 - 59	1,112,726	886,499	6,415,967
> 60	264,423	165,896	3,618,234
Total	21,167,848	16,632,908	44,095,238

Source: the National Statistics Office of Thailand (NSO) 2012 [38]

Thailand has been trying to provide equal educational opportunities so that people in the rural areas would have equally chance for education as people in the urban areas regardless of their economic status [39]. In the past, education in Thailand was limited to the urban areas. A couple decades ago, there were limited education institutions in the provinces hence it was difficult for provincial people to further their study from the mandatory primary and secondary levels. In spite of the government's supports to open higher education institutions in the provinces, the numbers of seats could not match the numbers of applicants. Nowadays because of the accessibility and lower costs, education institutions adopted the internet and utilized it as the tools to reach many people around the country.

Ramkhamhaeng University's blended distance teaching

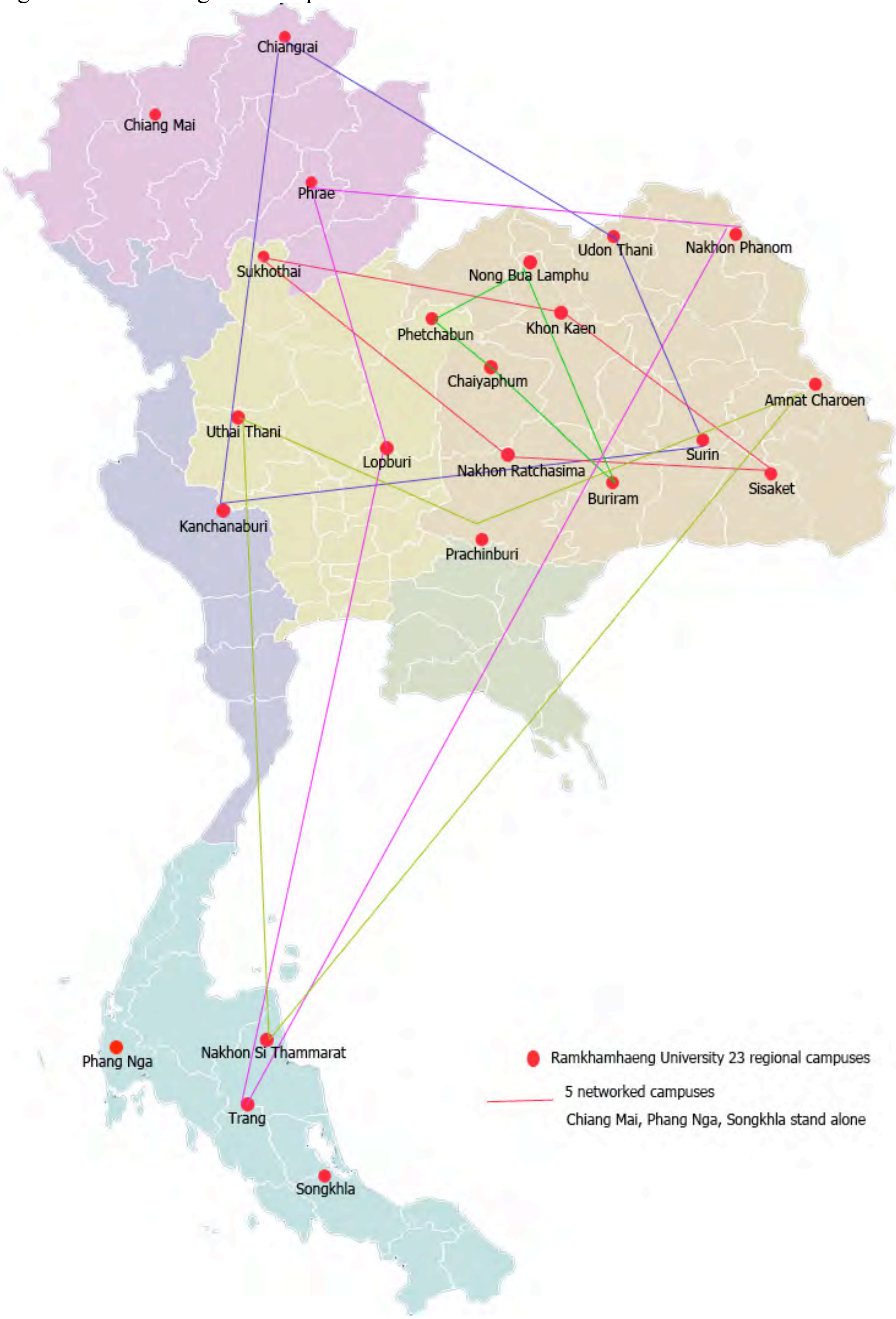
Before 1971, universities in Thailand had limited capability, regarding the facilities and personnel, to offer higher education to students. Moreover, many provincial students could not afford to study in Bangkok because of the high competition rate. The result was that many high school graduates were rejected from the higher education system. The government tried to solve this problem by establishing Ramkhamhaeng University (RU) in 1971 as an open university. The main purpose was to set up a place where high school graduates could further their study. The entrance examination was not required and the tuition fee was much lower than other universities to offer opportunities for low income students. All students who graduated from high school were welcome into the system. They could study in any field offered by the university with little restrictions. Since then a large number of students applied to study with RU. In order to cope with a large number of students while the facility was limited, RU pioneered Thailand's first long distance learning system. Classroom-based instructions were offered and broadcasted through radio and television network to provide accessibility to students throughout Thailand. The long distance learning was developed into video conference through television satellite broadcast in 1996 [40]. With the introduction of the internet system, RU could offer teaching and learning to a lot of people residing abroad as well.

In 2012 RU operated 23 regional campuses, 40 regional examination centers and 47 regional academic service centers throughout Thailand. Through the long distance teaching system, several academic programs were offered for people living around the world not limited only to Thais. 41 centers were established in order to provide services and examination facilities for students abroad. RU opened 12 faculties, two institutions and one graduate school that offered 194 programs to students. Moreover, the Institute of International Studies at the main campus handled foreign students from more than 50 countries. Furthermore, RU had two IT coaches equipped with computers and satellite dish which brought the internet and computers to serve some 60,000 people in 70 provinces in the rural areas [41].

RU blended electronic and face-to-face teaching and learning process. Regional campuses were established to offer learning away from the main campus, hence, RU consider this distance learning. Several tools were combined to offer distance learning, i.e., CD's, webboard, email, and etc. The graduate distance learning system was organized in the way that students were mandated to register and attend classes at one of the regional campuses of their choice. The purpose was to promote acquaintances and interaction among students. Usually, students would enroll in the campuses close to their bases. 4 regional campuses were grouped into one node or network. One subject was taught at each node at a time, i.e., students in each network or 4-5 regional campuses would study the same subject at the same time. Teachers would visit one of the four-five campuses to conduct face-to-face teaching each week. In the following weeks, the teacher would visit another campus in the same node. Eventually, all campuses would be visited. Students would know teachers in person. The teaching process was broadcasted through the internet to other campuses in the same node at the same time. All students in the node had the opportunity to interact with the teachers either on the face-to-face or teleconference basis. The central area is covered by the main and suburban campuses. In this manner, students throughout the country have access to RU's classes. Some pictures of the instructor visited the regional campuses are shown in figure 1. The network campuses are shown in figure 1. Moreover, the classes were recorded and posted on the university's website as well as distributed in audio and video formats. Students could review the classes at later date [42].

Figure 1 The author visited classes in the regional campuses

Figure 1 Network regional campuses



Methodology

The objective of this research project was to examine the students' opinions and preferences regarding the distance learning process of the university. Focus group interviews were performed at meeting rooms in 4 campuses belonging to the same node. 8-10 graduate students taking the same subject in these campuses were recruited for focus group interviews. The participation was voluntary. Questions related to the perceptions and opinions regarding the organization of the distance learning were asked. Students were allowed to freely comments and discuss their opinions. The interviews were recorded and transcribed verbatim.

Results

6 themes emerged from the analysis of the interviewed data. Most students in all campuses agreed in the same direction. There were very few conflicting opinions. The themes are as follows.

Social equalization

The most evident theme was that students like distance learning because of the accessibility to education. If the programs were opened only in Bangkok as before, they would face difficulty traveling or moving to study in Bangkok while maintaining their jobs in the provinces. Some respondents said they would have to quit their secure job if they want to further their study. With the establishment of the regional campuses to provide distance learning, they gain access to higher education with less sacrificing. Even though they have to attend the classes which make it a partially distance learning, the campuses were in the vicinity of their hometown. Some respondents also mentioned the regional campuses offer opportunity for undergraduate studies in the provinces as well. This provides social equalization regarding access to education to students in all level in the provinces. The upgrading of education would lead to economic and social development in the long run.

Interactivity

Many students reported they felt the teachers and colleagues were within their reach. They could contact the teachers at all time through either synchronous or asynchronous modes such as email or chat program which would not intrude the other party's privacy. If the others were "on," they could chat right away. If not, their query would be seen later when the teachers log into the system and the teachers could reply at their convenience. Sometimes they would contact the teachers through telephone. Moreover, students like to communicate with their colleagues to discuss and share knowledge, lecture, or summaries on the class's facebook account. They could ask for assistance from friends and teachers at any time. The interactivity provided students with supports in learning. They could talk to each other and learn as the whole team, thus created team learning.

Flexibility

Students found it easy to review their lessons at the time of their convenience. Sometimes they did not understand while studying in classes. Sometimes they felt they were not ready in class such as when they felt fatigue or stress from work and could not pay attention to the teachers. They knew they had the chance to come back to the parts they did not understand later. This could lessen their stress and create more confidence in their study. Student knew they would not miss the materials. Moreover, different students might be unclear or need assistance in different parts of the courses and the teachers could provide different additional materials to different students.

Dynamic materials

Students mentioned the teachers could update teaching materials or include hyperlinks to additional or complementary materials to provide better understanding. They reported that the materials were more up-to-date and relevant to them. Moreover, they had hand-on experience in using IT to retrieve and share knowledge with others. They commented that searching for information was less difficult than expected. If they were not enrolled in distance learning, they would be remote from using the internet as a source of learning and sharing with others. This enabled students to be engaged in life-long learning. They could continue learning from classmates and other people in other sphere of the internet even after they graduated from the university.

Interesting presentation of materials

The blended media exposed students to a large array of information in various presentation formats. Electronic media have the capability to deliver rich content. Video, pictures, audio, simulation, activities, and others could be organized to assist students' learning and understanding. In addition, class information was based on real practices rather than from texts alone. This made the teaching and learning to be attractive and enjoyable experience.

Motivation to learn and share knowledge

The blended system enabled students the convenience to participate in class discussion through their computers without being spotlighted in class. The sharing of knowledge could be performed easily. Many options were available for students to share ideas and opinions. They could join activities or follow discussions on the internet without being identified. Questions could be posed to facebook page or webboard without the identification of the recipients. Hence, questions were addressed to all colleagues. Those who were willing to answers would do so. Everybody had the chance to contribute ideas on everybody else's query. Through the IT system, the sharing of knowledge was not limited to only students in the same class but also students in other provinces and in other batches as well as outsiders. The barriers to learning and sharing of knowledge were reduced.

Discussion and recommendations

The Thai culture is a high context and collectivistic culture [43]. Many students found learning through IT a distance, and hence, alienated approach. They need to familiarize themselves with the teachers and colleagues. In doing so, the characteristics including face and gestures of the others in various setting should be observed. Knowing each other through the internet make it difficult for this process. Hence, students need to see each other in real person in order to about learn each other before engaging in any activity. This is different from students in the West. Students in the US might start discussing about a group project right away and learn about each other later but Asian students need to know another person before they could cooperate with others. The result was that they prefer face-to-face communication with others. Only after they come to know each other, the convenience of the IT interaction could be utilized.

In the distance learning context, learners' mindset should be prepared from being passive to be more constructive. Students should be more active in seeking and selecting knowledge relevant to them. We could not assume students know how to learn from the first place especially when we are talking about using relatively new technology. Distance learning system needs students to be actively engaged in the class activities else they could fade down and remain silent. The teaching and learning would be unsuccessful.

While it is necessary for students to be active, teachers should realize their changing roles from feeding students with their information toward being a facilitator to facilitate students' quest for knowledge. Teachers should be well prepared for the unexpected and respond to unconventional questions from students. They should inspire students from within. This is much harder than teaching in the conventional mode. It is necessary that teachers should open their minds and accumulate a wide range of information rather than information in the texts alone. Class materials should be kept updated with the inclusion of real life practices. Students' activities through the internet should be planned properly to induce cooperation and learning.

Teachers should be excelled in using and application of IT. There are various advantages and disadvantages of IT. Teachers must know and be keen in selecting and incorporating appropriate tools in classes in order to expose students to various applications and excitement of the IT so that students would be motivated and able to apply the IT technology further. The potentials usage of IT network should be utilized to their utmost benefits. Linkages to both internal and external resources should be included. In addition, group works might be planned so that students would use IT to produce and deliver their assignments. Teachers also should be active in providing feedback on the internet.

Teachers should learn about students beforehand in order to plan the approach properly. For example, if students were technology illiterate, teachers might spend one or two sessions to familiarize students with the application of IT. Types of IT students usually used should also be studied. Teachers could rely on those tools and add other tools so that students would be exposed to other IT tools. The content of the class should also be prepared properly to make them suitable to learn through blended teaching and learning system.

The blended learning system should be designed in order to provide convenience to students in the modern era. Students prefer convenience. If the system is complex or difficult to follow, they would lose their interest. The materials should be coordinated rather than dispersed. Linkages among the materials should be evident. The system should allow students to jump back and forth without losing track of the class. In this regards, hypertext is a great tool in link websites together. There is no need to put everything in limited number of pages which make it complicated and difficult to follow and take time to load the pages.

Conclusion

Blended learning is becoming more popular through the development of the infrastructure that supports the internet system in Thailand. Several advantages and disadvantages of the internet are evident and thus teachers must be selective in choosing the right combinations. The main objective should be to offer convenience and learning opportunity to students regarding the content of the course and also the IT literacy or practices. From the results, blended learning of face-to-face and online distance learning was supported by Thai students. However, the process needs careful consideration and planning in order to attain successful implementation. The tools are continuously developed. Teachers should keep up with such development and be selective in using the modern tools in order to facilitate the teaching and learning process.

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The MIT LINC 2013 Conference

Parallel Presentations

Session #7
Technology-Enabled Education for Pre-University Students: MIT BLOSSOMS and other K-12 Programs

- "Enriching 21st Century Higher Education Students' Job Creation Skill: UTM Academic Staff Perceptions Toward MIT BLOSSOMS" presented by Zaleha Abdullah (Malaysia)
- "Developing Information Communication Technology (ICT) Curriculum Standards for K-12 Schools in the Philippines" presented by Armin L. Bonifacio
- "Role of Class Teacher in Blended Learning Environment" presented by Muhammad Kashif Farooq (Pakistan)
- "Remote Mentoring Young Females in STEM through MAGIC" presented by Ira Pramanick and Esha Sahai (U.S.)
- "BLOSSOMS—Mini: A BLOSSOMS Experiment for Public and Private Schools in Pakistan" presented by Ovais Ahmed Tanweer
- "Educational Technology and its Acceptance Level Among the Students and Teachers in Some Rural Areas" presented by S K Wanchoo (India)
- "How well does Sparse Blended Learning Work? A Case Study from a Developing Country" presented by Imran A. Zualkernan (United Arab Emirates)

Enriching 21st Century Higher Education Students' Job Creation Skill : UTM Academic Staff Perceptions Toward MIT BLOSSOMS

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ABSTRACT

What are some generic skills or graduate student attributes required of 21st century higher education students by future employers? Besides English communication skill, team working skill as well as critical & problem solving skill, entrepreneurial skill is one of the generic skills that require serious attention in Malaysian universities. What are some characteristics of 21st century higher education students? What are some meaningful and interactive learning experiences that can equip them with these skills? Information and Communication Technology can be used to extend conventional teaching methods. Higher Education Institutions need to tap the potential and advantage of Information and Communication Technology towards engaging and enriching 21st century higher education students learning experiences. This paper thus attempts to explore the perceptions of UTM academic staff towards the use of an interactive learning environment - MIT BLOSSOMS - in enriching 21st century higher education students' entrepreneurial skill specifically on job creation. In this study, 12 UTM academic staff volunteered to view an interactive video lesson from the MIT BLOSSOMS web site and later was interviewed how they perceive that particular video lesson will be able to help enrich entrepreneurial skill specifically on job creation among higher education students. Findings in this study showed that all 12 UTM academic staff participated in the study perceived that the video that they have viewed should be able to contribute in enriching 21st century higher education students' entrepreneurial skill specifically on job creation.

KEYWORDS: New Academia, New Academia Learning Innovation Model, MIT BLOSSOMS, Entrepreneurial skill, Job creation.

Introduction

With the advent of Information and Communication Technology there is a phenomenal growth on e-learning or online courses in the last ten years. It is reported by the Sloan Foundation that in 2008, more than one in four higher education students took at least one online course and just a few years earlier, in 2002, it was only about 10%. The vast majority (82%) of these online students were undergraduate students (Allen & Seaman, 2010).

Information and Communication Technology can certainly be used to extend conventional teaching methods. If used appropriately, it has proven to be effective at the tertiary level of education. Higher education institutions should therefore continue to tap the potential and advantage of this technology towards enriching and engaging 21st century higher education students learning.

Presentation software can be used to create eye-catching presentations to entice students to pay attention. Electronic visuals can also provide a medium for easily incorporating multimedia into a lesson to better demonstrate an idea than through abstract words and static pictures.

The World Wide Web opens a seemingly limitless library of information and has increased the availability of information to the individual learner. It is now essential for students to become users of information rather than collectors of facts. Information is not the sole domain of academic staff. It is available to all who know how to find it and use it. The 21st century higher education students can search, select and synthesize much more information than they had ever previously considered possible.

Academic staff must therefore change their roles from being suppliers of knowledge to facilitators of knowledge. Online technology can play an important part in extending or transforming the learning environment to fit 21st century higher education students' changing needs.

Problem Statement

What are some skills required for jobs by future employers? Generic skills or graduate student attributes that require serious attention in Malaysian universities include English communication skill, team working skill as well as critical & problem solving skills. Entrepreneurial skill is also one of the skills that need to be inculcated and embedded among Malaysian higher education students.

Resolutions based on discussions among key industry players and academicians during International Conference on Teaching and Learning in Higher Education (ICTLHE 2012) in conjunction with Regional Conference in Engineering Education & Research in Higher Education (RCEE & RHEd 2012) which was held in Malaysia include:

- Graduates, among other things, acquire generic skills, must be able to create new jobs and create companies with new innovations.

- Graduates find it hard to communicate, unable to interact with colleagues and people, fail to display team spirit and face difficulties in adapting to the job market.

- Students are unable to relate and apply what they learn in classroom into real world application. Initiatives should therefore reduce the gap between classroom and real working environment.

In the last few decades there has been a gradual shift of understanding about how learning should be facilitated in higher education, towards an emphasis on Student Centred Learning (SCL) rather than Teacher Centered Learning (Ashwin, 2006; Schneckenberg, 2009).

What are some characteristics of 21st century higher education students? This 21st century higher education students want meaningful work, want to be involved and crave attention from mentor in the forms of feedback and guidance. These students grew up with technology and rely on it to perform their jobs better. These students prefer to communicate through e-mail and text messaging rather than face-to-face contact and prefer online technology to traditional lecture-based presentations. Online learning, in particular, has long been touted as a way to support students' learning (Flores, 2010) and some commentators such as Clarke (2002) consider it as a core skill in the twenty-first century.

Gardner (2008) book entitled, "5 Minds for the Future" described how students of the future think and act. The Disciplined Mind refers to student applying diligently, improving steadily and continuing beyond formal education. The Synthesizing Mind is a skill in selecting crucial information from the copious of information available and arraying that information so as to make sense to self and others. The Creating Mind pushes a student to go beyond existing knowledge and synthesize to pose new questions and offer new solutions. The Respectful Mind makes students responding sympathetically to differences among individuals and groups, and extending beyond mere tolerance. Finally, The Ethical Mind develops a student striving toward good work and good citizenship.

Understanding the characteristics 21st century higher education and learning methods used by them are essential in identifying methods and technology that are suitable for their learning needs. Will the use of meaningful and interactive learning experiences help enrich entrepreneurial thinking and mindset of these particular students? While meaningful refers to having meaning, interactive pertains to a two-way system of electronic communications, obtaining information and getting immediate results.

Possible Solution

New Academia Learning Innovation Model

With reference to the book, "New Academia" written by Zaini Ujang (2012), Universiti Teknologi Malaysia (UTM) envisions to be a global brand. Under the leadership of UTM Vice Chancellor Zaini Ujang, planning does not stop at that stage but rather projects are being implemented. This is because the projects that were proposed are realistic and achievable within a specified time period.

UTM initiatives to enrich Learning and Teaching (L&T) are based on well-known and best teaching and learning practices which have been proven to be effective. These best practices include Harvard Initiatives for Learning and Teaching (HILT), Harvard Business School Case

Studies (HBSCS), Peer Instruction (PI), MIT OpenCourseWare Consortium (OCC) and MIT BLOSSOMS (Blended Learning Open Source Science or Math Studies).

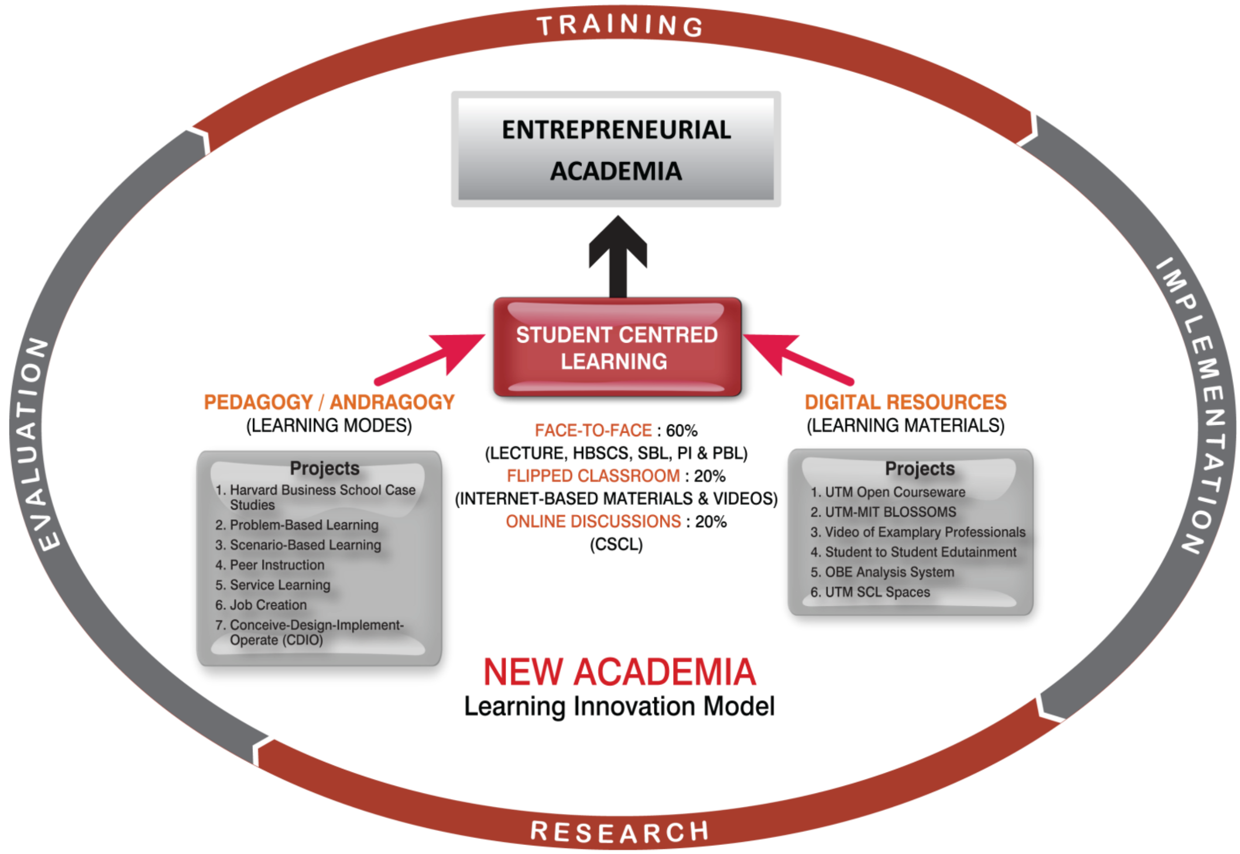

Figure 1.1: New Academia Learning Innovation Model

Based on this scenario, **New Academia Learning Innovation Model** (see **Figure 1.1**) which is under the **Key Focus Area (Academic & Internationalization)** attempts to create UTM own identity of teaching and learning models, activities, materials, systems and environments. In order to create memorable learning experiences among graduates, meaningful learning experiences and interactive learning experiences which are motivating and able to keep the attention of the students in relatively higher levels throughout the lecture is required.

Therefore, systematic incorporation of active learning strategies and digital learning materials into lectures may minimize many of the weaknesses of traditional lectures. In addition, online systems and learning environments will also help support Student Centred Learning (SCL).

Why UTM introduce New Academia Learning Innovatin Model?

Among the problems and rationale include:

In 2010, the Academic Performance Audit (APA) Panel suggested in its report that UTM, "need to ensure that the focus on research will not reduce attention towards quality and comprehensive teaching".

Based on the National Higher Education Strategic Plan Phase 2 (2011-2015) or *Pelan Strategik Pengajian Tinggi Negara Fasa 2* (2011-2015), and in particular Critical Agenda Projects (CAPs) Teaching and Learning, all (100%) university lecturers in Malaysia are required to use at least 1 Student Centered Learning (SCL) method by 2015.

MIT BLOSSOMS

Under New Academia Learning Innovation, there are projects that cater for meaningful and interactive learning experiences toward the inculcation of entrepreneurial skills among UTM 21st century higher education students. MIT BLOSSOMS is one of the New Academia Learning Innovation projects.

With reference to **Figure 1.2**, the MIT BLOSSOMS (Blended Learning Open Source Science Or Math Studies) is committed to enhancing math and science education around the world. MIT BLOSSOMS Video Library contains over 50 math and science video lessons on math and science fundamentals by relating abstract concepts to the real world.

Every video lesson is a complete resource which includes video segments, a teacher's guide, downloadable hand-outs and a list of additional online resources relevant to the topic. Each 50-minute video lessons are freely available as streaming video and Internet downloads.

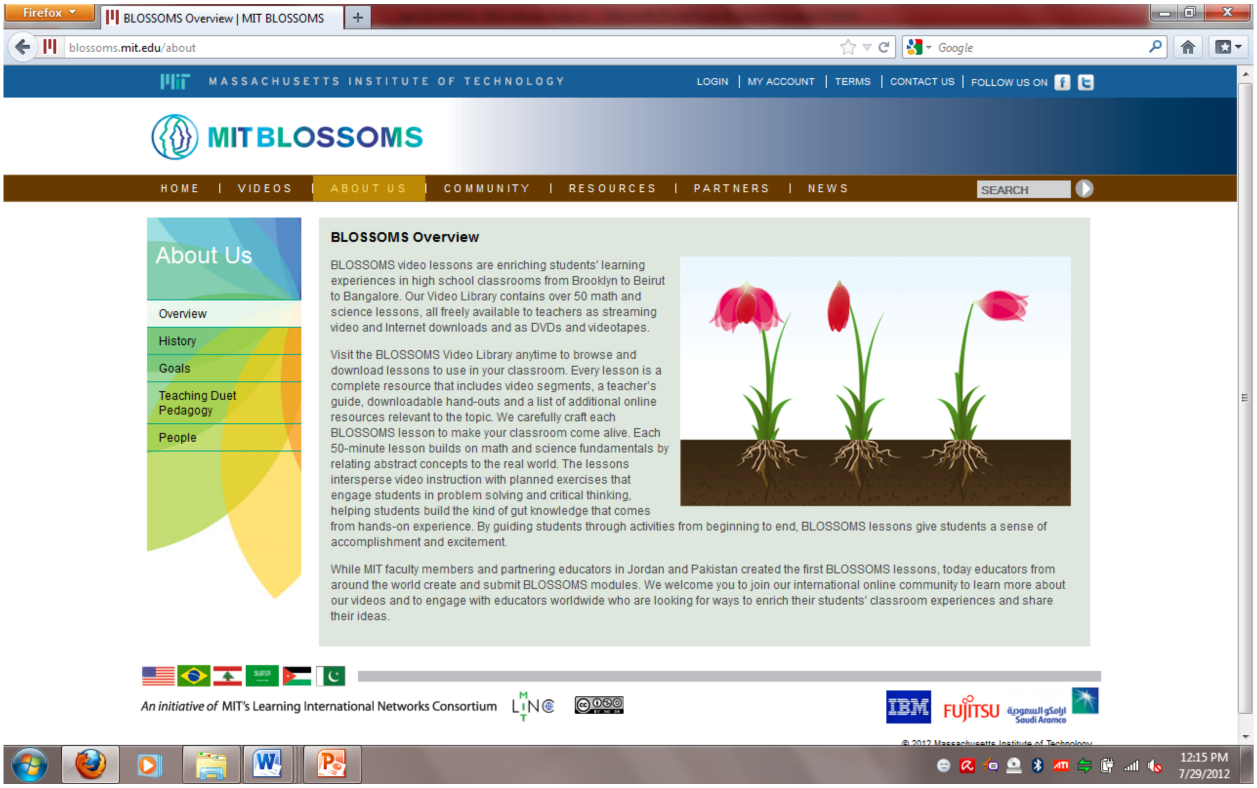

Figure 1.2: MIT BLOSSOMS web site (http://blossoms.mit.edu/about)

The MIT BLOSSOMS video lessons are interactive in nature with planned activities and hands-on experience that engage students in critical thinking & problem solving. Some video lessons can also contribute to enriching higher education students' entrepreneurial skills. By guiding students through activities from beginning to end, MIT BLOSSOMS video lessons give students a sense of accomplishment and excitement.

Research Methodology

The purpose of the study is to explore UTM academic staff perception toward MIT BLOSSOMS with respect to its usefulness in enriching UTM 21st century higher education students' entrepreneurial skill specifically on job creation.

The respondents who volunteered in the study consisted of 12 UTM academic staff from Science, Technology, Engineering and Mathematics (STEM) related areas. These UTM academic staff was instructed to view an interactive video lesson from the MIT BLOSSOMS web site (see **Figure 1.3**) that can be viewed online or downloaded from the MIT BLOSSOMS web site. Later, they were interviewed based on their perception toward that particular video lesson in enriching entrepreneurial skill specifically on job creation among higher education students.

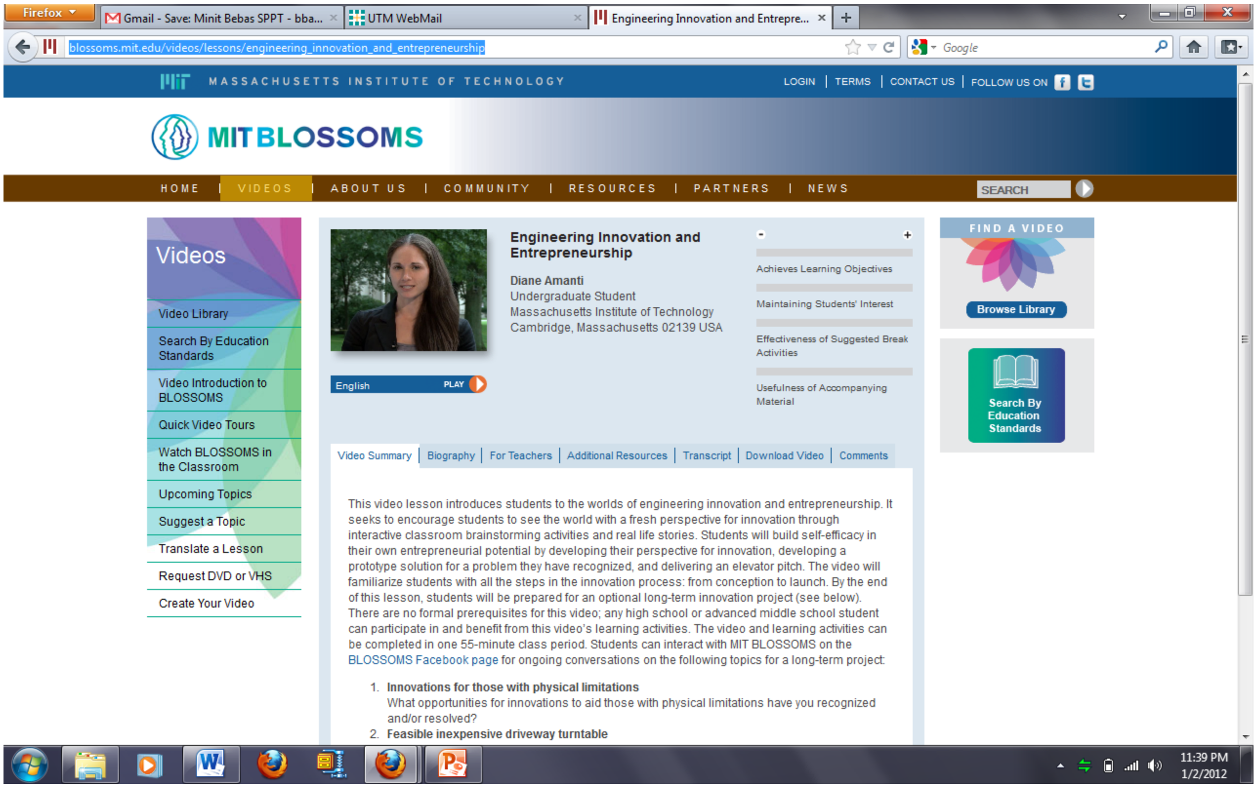

Figure 1.3: Engineering innovation and entrepreneurial (http://blossoms.mit.edu/videos/lessons/engineering_innovation_and_entrepreneurship)

This MIT-BLOSSOMS video lesson introduces students to the world of engineering innovation and entrepreneurship. It includes real life story and students actively involved in the lesson through interactive classroom brainstorming activities. Students are expected to identify a problem, suggest a new prototype solution or innovation and later seeking entrepreneurial potential.

Results of the study

General findings in this study indicated that all 12 UTM academic staff who participated in the study perceived that the video that they have viewed should be able to contribute in enriching 21st century higher education students' entrepreneurial skill specifically on job creation. Blended learning can leverage the advantages of both face to face and digital teaching materials (Lou et al., 2011; Shih, 2011).

Specific findings based on the discussions include the following 5 criteria:

Content

All the academic staff agreed that the content in the MIT-BLOSSOMS video lesson is suitable to enrich entrepreneurial skill specifically on job creation among students. The content is systematically planned and well-structured.

Academic staff A8 expresses:

> The contents were stimulating. Enough concepts were included in the video lesson that makes the lesson clear. Also, the developments of the concepts were very clear and systematic. Overall, I personally think the MIT-BLOSSOMS video lesson did improve my knowledge on systematic steps towards being an innovator, job creator and entrepreneur. If it works for me, I am confident that it will work for UTM students.

Flexible delivery

All the academic staff perceived that the structure of the MIT-BLOSSOMS video lesson is user-friendly since it allowed them to move freely and can repeat the same lesson as many times as they wanted. Digital technologies have the potential to support and shape a pedagogy which is more active, participatory, personalized, flexible, and inclusive (Laurilland, 2008).

Individual pace

All the academic staff agreed that the MIT-BLOSSOMS video lesson allows users to work at their own pace. The learner can actively participates in the construction of knowledge through situated and authentic tasks on individual basis to support deep, rather than surface, learning (Lai, 2008).

A comment made by one of the academic staff really showed that she was determined to push herself beyond the boundaries of the computer-based learning session. Academic staff A12 reacts:

> After using the MIT-BLOSSOMS video lesson, I feel like wanting to get more of such videos lessons.

Team working

All the academic staff agreed that the MIT-BLOSSOMS video lesson can help promote students to work in groups and produce a project that can be executed by a group of students. This MIT-BLOSSOMS video lesson can also encourages and improves discussion, interaction and collaboration among students (Lou at al., 2010; Shih, 2010; Wang, 2010).

Availability of computer

There was a word of caution among the participants. They said that students will be unhappy with computer based learning if support is lacking. Instructor's support is also essential while students are using MIT-BLOSSOMS video lessons.

Academic staff A3 confesses:

> I thought I would get burned out in teaching, but now I am excited about teaching again. This time around, I will try to use computer and information technology. Thanks to the MIT-BLOSSOMS video lesson. It really helped me think, and give me ideas about what I can do in the classroom.

Concluding Remarks

Developing these MIT-BLOSSOMS video lessons requires multiple levels of design and development effort and skill. Creating MIT-BLOSSOMS video lessons is also a tedious and complex task. Despite the tedious and complex task, how well do these video lessons be accepted by its users who are primarily the 21st century higher education students? Will it be effective in engaging and enriching students learning? This are some questions that can be taken in account for future research studies on implementing MIT BLOSSOMS at UTM.

From the results and discussion of this research, it can be concluded all the 12 UTM academic staff were positive towards the usefulness of MIT-BLOSSOMS in enhancing UTM 21st century higher education students' entrepreneurial skill specifically on job creation. However, there are some limitations to this study that include small sample size during the interview sessions. Also, there is a need to incorporate other strategies of data collection such as observations to observe how students approach learning.

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Developing Information Communication Technology (ICT) Curriculum Standards for K-12 Schools in the Philippines

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Abstract

Integrating Information and Communication Technology or ICT into teaching and learning has become a great concern for many educators in developing countries like the Philippines. ICT must be used and taught in powerful and meaningful ways. With its rapid development, educators should find ways to integrate technology in the learning process. ICT should not drive education, rather, educational goals and needs must drive its use in schools. Targeting holistic growth for learners is a crucial factor in realizing the need to develop ICT curriculum standards for K-12 schools in the Philippines. The researcher believes that developing these standards is a decision making process that will dictate how Filipino students will acquire ICT concepts and skills to help them achieve the greater benefits of learning.

Introduction

Setting standards is an important and effective learning tool because they express clear expectations of what all learners should know and be able to do. For the country, standards are a common reference tool and provide a defined framework for national testing. For schools, standards provide a focus for developing new ways to organize curriculum content, instructional programs and assessment plans. For the teachers, standards will help them design curriculum, instruction and assessment on the basis of what is important to learn. They also enable teachers to make expectations clear to students, which improves their learning. For students, standards set clear performance expectations, helping them understand what they need to do in order to meet the standards (Steiner, 2000).

ICT curriculum standards for K-12 schools in the Philippines will serve as a framework for technology integration in various academic content area instructions from kindergarten through grade 12, function as a guide for curriculum decisions by providing student performance expectations in the areas of knowledge, skills and attitudes, and provide examples of classroom activities and instructional strategies utilizing ICT that will guide teachers as they design instruction to help their students meet learning expectations.

The Need to Develop ICT Curriculum Standards

The process of integrating standards into the curriculum should emphasize learning and growth for all as the natural and desired outcome of reform in the schools. From that perspective, a standards-based curriculum includes not only goals, objectives, and standards, but everything that is done to enable attainment of those outcomes and, at the same time, foster reflection and revision of the curriculum to ensure students' continued growth (Pattinson & Berkas, 2000).

This process consists of four steps (Pattinson & Berkas, 2000): (1) developing a curriculum framework in the context of standards-based reform; (2) selecting a curriculum-planning model that further articulates the standards-based reform outlined in the framework; (3) building capacity at all levels of the educational system; and (4) monitoring, reflecting upon, and evaluating the curriculum as teachers implement it in the classroom.

Instruction integrating ICT in Philippine schools will be created based on these standards. Curriculum content will be created after carefully selecting and analyzing the standards to be met. Educators should refer to the targeted skills for each content area and grade level as they plan and implement their classroom activities. Instructional activities and assessments are to be selected and designed through which students can demonstrate mastery of standards.

Standards help to determine what students must know or be able to do to perform well on the assessment. The instructional plan should provide all students with adequate opportunities and different teaching strategies to accommodate learning styles and needs in order to learn and practice the necessary skills or knowledge provided in the standards.

Because ICT is complex, having a well-defined set of curriculum standards in the Philippines will guide educators in defining and meeting the technology knowledge and skills Filipino students need in their current academic, tertiary education and future work requirements thus making them globally competitive. With the implementation of the K-12 curriculum, a new DepEd mandate wherein students will extend for two more years in secondary school, much more funding is needed, and much more learning is expected.

While DepEd continues to grapple with the problem of improving quality and broadening access, new challenges to educational institutions have emerged within the context of globalization, the rapid development of new digital technologies, and the transition to a knowledge-based economy. In a knowledge-based economy, knowledge is the most precious asset, driving growth, wealth-creation, and employment, and education serves as the key to economic and social mobility.

ICT in Instruction

Research has indicated that the use of ICT can support new instructional approaches and make hard-to-implement instructional methods such as simulation or cooperative learning more feasible. Moreover, educators commonly agree that ICT has the potential to improve student learning outcomes and effectiveness. Integration has a sense of completeness or wholeness, by which all essential elements of a system are seamlessly combined together to make a whole (Chang & Wu, 2012). Schools have seen an exponential increase in the range of ICT being utilized for learning and teaching over the past decade, especially with the advent of the Internet. What is exciting is not just more technology but that there are more types of technology which teachers can pick and choose from, based on their own pedagogical preferences (Choy, Suan & Chee, 2012).

ICT can improve the quality of education and heighten teaching efficiency through pre-service training and programs that are relevant and responsive to the needs of the education system. This will allow teachers to have sufficient subject knowledge, a repertoire of teaching methodologies and strategies, professional development for lifelong learning. These programs will expose them to new modern channels of information, and will develop self-guided learning materials, placing more focus on learning rather than teaching. However, it is important to point out that ICT is used to enhance teaching styles, and "should not replace the role of the teacher."

ICTs in a Learner-Centered Environment

If designed and implemented properly, ICT-supported education can promote the acquisition of the knowledge and skills that will empower students for lifelong learning. When used appropriately, ICTs, especially computers and Internet technologies, enable new ways of teaching and learning rather than simply allow teachers and students to do what they have done before in a better way. These new ways of teaching and learning are underpinned by constructivist theories of learning and constitute a shift from a teacher-centered pedagogy, in its worst form characterized by memorization and rote learning, to one that is learner-centered (Tinio, 2002). Following are some of learning approaches ICT can promote:

Active learning. ICT-enhanced learning mobilizes tools for examination, calculation and analysis of information, thus providing a platform for student inquiry, analysis and construction of new information. Learners therefore learn as they do and, whenever appropriate, work on real-life problems in-depth, making learning less abstract and more relevant to the learner's life situation. ICT-enhanced learning promotes increased learner engagement.

Collaborative learning. ICT-supported learning encourages interaction and cooperation among students, teachers, and experts regardless of where they are. Apart from modeling real-world interactions, ICT-supported learning provides learners the opportunity to work with people from different cultures, thereby helping to enhance learners' teaming and communicative skills as well as their global awareness. It models learning done throughout the learner's lifetime by expanding the learning space to include not just peers but also mentors and experts from different fields.

Integrative learning. ICT-enhanced learning promotes a thematic, integrative approach to teaching and learning. This approach eliminates the artificial separation between the different disciplines and between theory and practice that characterizes the traditional classroom approach.

Evaluative learning. ICT-enhanced learning is student-directed and diagnostic. Unlike static, text- or print-based educational technologies, ICT-enhanced learning recognizes that there are many different learning pathways and many different articulations of knowledge. ICTs allow learners to explore and discover rather than merely listen and remember.

Creative Learning. ICT-supported learning promotes the manipulation of existing information and the creation of real-world products rather than the regurgitation of received information.

Project-based learning (PBL) is a constructivist pedagogy and class-oriented learning approach involving long-term, theme-based learning and student-centered activities that focus on daily life problems. It can be an ICT-enhanced learning that allows students to use an inquiry-based approach to engage with issues and questions that are real and relevant to their lives (Curtis, 2001).

Technology for schools should focus on enhancing learning rather than minimizing work for students. ICT standards for K-12 schools in the Philippines should focus on skills that have real-life practical application, helping students function in the world in which they live. Standards will aid educators to develop lessons that will allow students to use learned skills in other academic content areas, motivate them to learn more, provide them opportunities to collaboratively learn with other learners, and help them develop various intelligences.

ICT Integration in Philippine Education

ICT is introduced at the elementary level as a subject called Home Economics and Livelihood Education (HELE) and in the secondary level as Technology and Home Economics (THE). In the majority of cases, ICT materials such as software and multimedia, are used to supplement instruction.

Philippine DepEd has policies on the use of ICT. These are: (1) technology must be studied first as a separate subject, then applied in other learning areas as a tool for learning how to learn; (2) the application of computer skills to the other learning areas is a curriculum policy that stems from the principle that teaching-learning must not be textbook-driven, and educational processes should take advantage of technological developments, including the application of ICT in teaching and learning, where appropriate; and (3) an education modernization program will equip schools with facilities, equipment, materials and skills and introduce new learning and delivery systems necessary to capitalize on recent technological developments.

The bulk of investment requirements for implementing ICT in education come from government funding. However, the DepEd involves other government agencies, local governments and the private sector to finance various components of building up a program in ICT in education.

A national population survey of public and private elementary and secondary schools was conducted by SEAMEO INNOTECH Philippines in 2001 to determine ICT capabilities of schools. A total of 45,811 schools from the 16 regions of the country were given questionnaires, with the school heads as respondent, of which 79.37% responded. The questionnaire focused on the readiness of schools in terms of infrastructure, hardware, software and manpower capabilities on ICT. Some of the major findings of the survey at the national level showed that 5,217 schools only or 14.28% have computers with the National Capital Region having the highest percentage at 87.30%, only 18.24% of schools have staff proficient in the use of computers, and only very few schools (13.13%) have school heads with ICT training in the previous 5 years.

The survey also indicated the need of these schools to implement standards for technology use. What kinds of changes in knowledge, skills and competencies are required from teachers and students in the use of ICT? In order to serve as a basis for developing knowledge, skills and competencies in the use of ICT, as well as in comparing outcomes of ICT use against goals set, few countries have set standards for technology use.

The primary factor that influences the effectiveness of learning is not the availability of technology, but the pedagogical design for effective use of ICT. The computer should be fitted into the curriculum, not the curriculum into the computer. Therefore, effective ICT integration should focus on pedagogy design by justifying how the technology is used in such a way and why. Effective ICT integration into the learning process has the potential to engage learners (Wang & Woo, 2007).

More and more, schools and universities present themselves as innovative educational institutes by utilizing web-based technology or the Internet to deliver instruction. In the last few years, there is an emergence of distance education programs in the Philippines, particularly in tertiary level, like the University of the Philippines Open University (UPOU), the largest that offers undergraduate and graduate school programs recognized by the Commission on Higher Education. From the business sector, many BPO companies cater to providing English online learning classes to students mostly outside the country. A-Plus Languages Online is a company that delivers language online instruction to some primary, secondary and tertiary private schools in Metro Manila. Using ICT tools, students can learn Mandarin synchronously with teachers who are based in Xiamen, China.

Though there is a wide use of the Internet in the business sector, more than 70% of schools have no access to the Internet, particularly the public schools. The schools in Metro Manila, have the greatest access to the Internet, but the incidence of connectivity decreases as one goes northwards and southwards throughout the archipelago.

Government Initiatives

In 2002, the Restructured Basic Education Curriculum was conceived. This aimed to implement an interactive curriculum that promotes integrated teaching and interdisciplinary, contextual and authentic learning. Interactivity is made possible with the use of technology in instruction and the greater emphasis on computer literacy in all learning areas in every school where equipment is available.

The Philippine Education Technology Master Plan has the following operational targets by the year 2009: (1) all public secondary schools shall be provided with an appropriate educational technology package; (2) 75% of public secondary schools shall have a computer laboratory room equipped with basic multimedia equipment; (3) all public secondary schools shall have an electronic library system; (4) 75% of public secondary schools teachers shall have been trained in basic computer skills and the use of the Internet and computer-aided instruction; and (5) all learning areas of the curriculum shall be able to integrate the application of ICT, where appropriate.

The Act of 1998 (R.A. 8525) was passed to generate private sector participation in the upgrading and modernization of public schools, especially those in underserved provinces. Recipient schools were selected based on the criteria adopted under the computerization program. In all, 110 public high schools received computers in 1996 under the DOST Engineering Science Education Project (ESEP) and an additional 68 public high schools were recipients under the DOST Computer Literacy Program. DOST continues to allocate some PHP 20,000,000 to 30,000,000 (US$ 400,000 to 600,000) annually to support computer acquisition in schools. In 2002 and 2003, 125 public high schools were to be provided with 10 to 15 computers along with the corresponding teacher training programs.

In collaboration with University of the Philippines National Institute for Science and Mathematics Education (UP-NISMED), a project to integrate ICT in the 2002 Basic Education Curriculum (BEC) was developed and served as a framework for ICT integration in Science and Mathematics for primary and secondary schools.

Centers of excellence in information technology, crossing traditional boundaries, were established in order to focus on the needs of a greater number of learners. Three information technology centers were set up, two elementary and one secondary, in each of the regions. Each center was provided with a laboratory equipped with computers, printers, peripherals, a multimedia projector, an air-conditioning unit and software programs. Teacher training was also a component. For the first year of operation, operating funds were provided by the government, and the Local Government Unit was expected to supply funds for the maintenance and continuous operation of the facilities.

Computers for Public Schools Project (PCPS), funded through a grant of PHP 600,000 (US$ 12 million) from the Government of Japan, secured largely through the initiative of the Department of Trade and Industry. The grant has benefited 996 public secondary schools across the country through the provision of 20 desktop computers, two printers, one fax/data/voice external modem with cable, one software package and teacher training to each of recipient-schools.

Data and information available show that the Philippines has eagerly embraced ICT in education. With facilitation by the Department of Education, and collaboration with the private sector, several initiatives have successfully equipped a number of schools with ICT facilities. Nevertheless, the initiatives have not insured that teachers fully use the facilities for teaching purposes (Belawati, 2004).

Requirements for Efficient Implementation of ICT Integration in the Philippines

Studies of ICT development in both developed and developing countries identify at least four broad steps through which educational systems and individual institutions typically proceed in their adoption and use of ICT (Majumdar, 2012). The *emerging* stage is when educators are just becoming aware of the potentials of ICT in education. The *applying* stage is the time teachers are starting to learn how to use ICT for teaching and learning. The *infusing* stage is when a host of ICT tools are used and integrated into the curriculum. Finally, the *transforming* stage involves the development of new ways of teaching and learning using ICT to explore real-world problems through innovative learning.

Implementation Plan

Recognizing the potential benefits of integrating ICTs in education systems, DepEd launched the National Strategic Planning Initiative for ICTs in Basic Education in February 2005 as part of a system-wide reform process to bring Philippine basic education out of crisis.

This National Framework Plan sets three parameters for the use of ICTs in basic education, namely, appropriateness, effectiveness, and sustainability.

Appropriateness refers to suitability in context. Factors to consider in choosing an ICT resource is the learning goal and objective to be met, the content of the material and its availability and accessibility to students. The most appropriate ICT tool does not need to be the most up-to-date or expensive available in the market.

Effectiveness refers to the extent to which stated goals and objectives are realized. When used appropriately, ICTs are powerful tools that can improve motivation and engagement in the learning process, develop multiple intelligences, facilitate comprehension of abstract concepts, promote inquiry and exploration through the use of interactive learning resources, enhance information literacy, critical thinking, problem-solving, and other higher order thinking skills. ICT can facilitate collaborative and cooperative learning by providing tools for learners to communicate and work with other learners, and develop lifelong learning skills, including learning how to learn.

Sustainability is defined as the extent to which the implementation of an ICT-based project (in the context of basic education) can continue after initial project funding or support has ended.

Teacher Training

A student’s academic achievements are often used to evaluate teaching effectiveness and are influenced by the use of technology in school. In other words, a student’s use of technology represents the teacher's integration of technology into teaching and curricula and also affects the teacher's effectiveness (Chang & Wu, 2012).

A study showed that students' academic achievements are noticeably influenced by the teacher's use of technology. A teacher's technological literacy directly affects whether students can incorporate technology into the curriculum to improve students' academic achievements (Chang & Wu, 2012). Educators must be knowledgeable in their subject matter and current in the content standards and teaching methodologies of their discipline. Teacher candidates should learn to use technology in ways that support attaining the content standards.

To enhance teachers' skills and competencies in technology integration, the following are recommended (Almekhlafi & Almeqdadi, 2010): (1) deliver workshops on effective technology integration; (2) provide teachers with appropriate ICT tools in the classroom; (3) provide teachers with incentives and awards for outstanding technology integration in their classrooms; (4) provide teachers with some release time so that they can plan effectively for technology integration in teaching and learning; (5) explore the use of technology in classrooms covering all school levels, including public and private schools; (6) investigate the effect of technology integration on students' achievement and attitude; (7) evaluate technology integration in relationship to curriculum goals and outcomes .

Since 2000, DepEd has given preference in hiring Filipino teacher-applicants who were computer literate. In most teacher training institutions, computer education is now a required course. For those who are already employed as teachers, in-service training is provided. Intensive training on electronics and assembly of computers for THE teachers of 110 science and technology oriented high schools and other special science high schools is offered. The objective of this training is to ensure that teachers in schools with special science & technology programs have the appropriate technology skills.

Even though the Philippine government has initiated several programs and projects for the use of ICT in education, real implementation in day-to-day learning is still limited. Teachers' fear of technology still hinders the optimal use of ICT-related skills in their teaching activities.

Despite various training programs having been provided to Filipino teachers, there is still a need to embark on a comprehensive and sustained in-service training for teachers. Usually, public schools send a few teachers to computer literacy training, who would then pass on the training of peer teachers. Private schools hire ICT service providers to give training to their teachers. Public school teachers handling THE classes receive training on ICT. Since 1997, the DepEd has intensified the provision of ICT training to teachers of English, Science, Mathematics and THE.

Technological Leadership

To be an experienced and capable technological leader, school administrators such as the principal, must be trained in vision, planning and management. This is the most important foundation of technological leadership. A technological leader must develop a vision of how school reform will be affected by technology. Planning and establishing resources for staff development are the most important responsibilities of a technological leader, followed by ICT tools and infrastructure support and evaluation and research. Effective technological leaders must administer procedures for measuring the growth of each individual teacher. They also must set technological targets and introduce professional development plans (Chang, 2012). A systematic development program for these leaders' needs must be implemented to change their mindset so they appreciate the value of ICT in education.

Potential Challenges

Countries everywhere are facing similar challenges in implementing ICT in their education systems. Unfortunately, many local, national and regional government bodies are still not giving ICT the attention and priority it deserves despite the benefits it brings. Providing basic access to ICT to young people living in either impoverished communities or rural locations often neglected by policy makers is one major challenge being faced (Gutterman et al, 2009).

Lack of Facilities

One of the greatest challenges in ICT use in education is balancing educational goals with economic realities. ICTs in education programs require large capital investments and developing countries need to be prudent in making decisions about what models of ICT use will be introduced and to be conscious of maintaining economies of scale. Ultimately it is an issue of whether the value added of ICT use offsets the cost, relative to the cost of alternatives. Put another way, is ICT-based learning the most effective strategy for achieving the desired educational goals, and if so what is the modality and scale of implementation that can be supported given existing financial, human and other resources?

Philippine schools use computers mainly in a technology subject (THE) for predominantly senior high school classes for formal study of the technology, with relatively limited application to other learning areas. The integration of technology across the curriculum has been constrained by the lack of ICT resources. In non-formal education, there is very limited use of information technology because out-of-school youth and adults participating in non-formal education programs generally do not have access to computers.

ICT usage depends first on whether there are enough ICT facilities. The research studies focusing on the barriers to use ICT reveal that the insufficiency or lack of ICT facilities appears as significant barriers (Usluel, Askar & Bas, 2008). Lack of basic infrastructure such as classrooms and Internet connectivity are hindrances in effective implementation of ICT curriculum standards in the Philippines.

Although the Philippines never falls behind neighboring South East Asian countries in terms of ICT infrastructures in government and corporate environments, there is much to be done with schools, especially the public schools and those in the rural areas.

Computers in Philippine schools are acquired mostly through purchases using school funds or through donations by government and private groups for many public schools. Not all elementary and high schools have their own computer lab. Philippine-based Foundation for IT for Education and Development (FIT-ED) 2002 Survey, only 13% of the schools have Internet access, 9% of schools have computers with Internet access available for teacher use and 8% of schools have computers with Internet access available for student use. A Department of Science and Technology (DOST) survey showed that among the 16 regions in the country, access to information technology at the secondary school level varies from a low of 34% to a high of 98%. Metro Manila, as the center of commerce and industry in the country, has the greatest access to computers, while the Visayas and Mindanao have the least.

Much work still needs to be done to ensure that computers and other ICT equipment deployed in public secondary schools are used to improve the quality of teaching and learning. In a 2002 survey of ICT use in 100 Philippine public secondary schools, Tinio (2002) reports that in majority of the schools surveyed, only half or less of their teachers and students had been able to use the computer as an educational tool. Moreover, the predominant use of computers was in computer classes taken by students in their junior and senior years in secondary schools. Using computers for other content areas such as math and science is still difficult for most public schools. While more secondary schools now have computers, student-to-computer and teacher-to-computer ratios remain extremely poor.

Another reason for lack of ICT integration in teaching is the limited number and variety of subject-specific educational software available in schools. Software in schools consists mostly of office software or productivity tools for word processing, slide presentations, numeric spreadsheet, or database management. Educational software for learning Science, English and Mathematics are few (Tinio, 2002).

The absence of specific curricular standards and guidelines for integrating computers into the subject areas is another important reason for the limited use of ICT in classroom instruction. IT curriculum covering basic computer and Internet literacy skills (and in some cases, basic programming) for the last two years of secondary school can be followed mostly by private schools. With the full implementation of the K-12 curriculum in 2016, schools should offer more opportunities for students to experience technology-supported learning that is interactive, interdisciplinary, collaborative and authentic.

Teachers' Knowledge, Skills and Attitude

Making computer labs available in Philippine schools is not enough. It is important for teachers to understand the precise role of ICT so that they can effectively cope with innovations in teaching students. Teachers are less likely to integrate technology into their instruction unless they accept the notion of the requirement of technology use in their classroom environment. The central questions with regard to technology acceptance are how individuals perceive technology and which factors contribute to the lack of utilization (Kiraz & Ozdemir, 2006). The lack of both technical and pedagogical knowledge and skills of the teacher to use available ICTs in the classroom becomes the major constraint.

The use of technology for teaching requires the development not only of knowledge, skills, and behaviors but also of appropriate attitudes (Kim & Baylor, 2008). Attitudes might be influenced by concerns, confidence, and so forth. For example, pre-service teachers' attitudes toward a technology are affected by their confidence in using it. Even though technology is available, and teachers have the requisite skills and knowledge, if they are not confident in using technology for teaching, they might be unwilling to do so.

Attitude toward ICT integration in instruction, and the level of knowledge and skills of teachers in the Philippines vary due to demographic, geographic, economic and regional differences.

Role of Leadership

One of the most fundamental problems in educational reform is that educators do not have a clear and coherent sense of the reasons for change, what it is and how to proceed. In order to accomplish lasting reform, we need leaders who can create a fundamental transformation in the learning cultures of school (Fullan, 2002). In other words, working on changing the mindsets and perceptions of the end-users who are really the teachers, to make them more open to change, is as important as the technology itself. Often, the teachers who resist change are not rejecting the need for change but are resisting entering into something that they do not have the necessary knowledge and skills for (Choy, Suan & Chee, 2012).

Conclusion

ICTs can be used to improve the quality of learning. They can promote learner motivation, mastery of basic concepts, and the development of higher order thinking and lifelong learning skills.

However, ICT is complex and confusing, and it deeply encroaches on the processes of education. Lack of vision, lack of consensus and lack of policy on how to integrate ICT in education consistently, are not very helpful either (Westera, 2005). ICTs, cannot by themselves resolve educational problems in the developing world, as such problems are rooted in well entrenched issues of poverty, social inequality, and uneven development. What ICTs as educational tools can do, if they are used prudently, is enable developing countries to expand access to and raise the quality of education. Prudence requires careful consideration of the interacting issues that underpin ICT use in the school, policy and politics, infrastructure development, human capacity, language and content, culture, equity, cost, and not least, curriculum and pedagogy (Tinio, 2002).

Motivation, innovation and sustainability of ICT development programs depend on the kind of leadership that exists. Educational leaders are effective when they are able to influence members of the organization to believe what they believe. Resistance is often encountered when change is introduced. Yet, it takes a good leader to plan, persuade and perform actions that will allow the different functions to collaborate, share resources and work together to achieve a common goal. Technological leadership is a crucial component in order to develop and implement ICT curriculum standards. Teachers' attitude, skills and acceptability of utilizing ICT in the classroom pose as an apparent obstruction, however, the support coming from school principals and administrators and the government to innovate, monitor and sustain good practices is a major contributor to the success of implementing these standards.

Developing ICT curriculum standards for K-12 schools in the Philippines seems to be a long decision process, yet the urgency to do it should be realized now as technology is becoming more and more crucial in the lives of Filipinos as they follow the path of economic growth and strengthening of a nation. The researcher believes that the first step is to accept the need to formulate these standards, know and prepare for the challenges ahead, have the will to pursue it by utilizing whatever resources are available, and be able to carry on the appropriateness, effectiveness and sustainability of ICT integration in schools, keeping in mind that its success lies in the hands of Filipino educators who are committed to make their education system work in the midst of many barriers to learning.

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Role of Class Teacher in Blended Learning Environment

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Abstract
Blended learning is almost perfect approach that covers both activities including class interaction with teacher and teaching aids such as virtual teacher, digital media etc. BLOSSOMS (Blended Learning Open Source Science Or Math Studies) is an initiative of MIT to develop a huge open and free resource of conceptual videos for high school math and science levels produced and gifted by volunteer faculty members initially from MIT and beneficiaries are the educators in various countries.
In Pakistan, various techniques were used to promote BLOSSOMS during last few years. Recently, a novel experiment was exercised i-e "Blended Learning Teaching Competition". It was realized that classroom teacher is an anchor person of whole blended learning show. This role is responsible for the best utilization of BLOSSOMS modules and involvement of learner. At the end, lesson learned have been suggested for better execution.

1 Blended Learning
Learning always includes a combination of inputs such as new information blending with existing knowledge, concepts from a lecture reasoning with personal experience, a diagram illustrating a new viewpoint on a written description or discussion with peers clarifying chapters from books [1]. With advent of Information and Communication Technology (ICT), blended learning modernized and considered to be the proper combination of technologies in addition to face to face learning [2]. Blended learning is also a bridge between traditional teaching and online teaching [3].

Blended learning approach may be considered as extended form of traditional learning because it is a mixture of technologies just like a delicious soup which is the appropriate mixture of ingredients. Learning impact depends upon the proper usage of technologies with face to face teaching enrolments [4].

2 BLOSSOMS Initiative
BLOSSOMS (Blended Learning Open Source Science Or Math Studies) is an initiative of MIT (Massachusetts Institute of Technology) LINC (Learning International Networks Consortium) to promote e-learning by joint effort of educators from MIT and other countries. The objective of BLOSSOMS is to build an online resource of free and open video library. These conceptual videos are contributed by volunteer teachers of MIT and other partner countries. Initially video modules developed in five areas and these are mathematics, engineering, physics, biology and chemistry. These video modules are not aimed to change the existing syllabus of high school level but rather to improve the teaching for conceptual learning, promote the critical reasoning and creating interest for advanced studies. These video modules are not simple video lectures; these are based on blended learning pedagogy.[3, 5, 6].

Demand-supply aspect of BLOSSOMS initiative may define supply side as development of BLOSSOMS video modules and demand side is the usage of these video modules.

This paper focuses the demand side. Demand always encourages the expansion in supply. LINC's aim sports the demand side

LINC's premise is simple and compelling:

> ***With today's computer and telecommunications technologies, every young person can have a quality education regardless of his or her place of birth [3].***

3 Blended Learning Pedagogy

Traditional teaching approach is teacher-centered. This approach based on pedagogies that focus on memorization, and overlooking the logical/conceptual understanding, logical reasoning and implementation of learning. In such a way, students are not involved actively and overloaded with knowledge to be memorized. Innovative minds may ignored in these conditions [7].

BLOSSOMS pedagogy is very optimum in nature. BLOSSOMS video module is far different from a simple video lecture. Generally, it consists of four to five small segments of duration 4-5 minutes each. BLOSSOMS teacher gives concept in a segment and at the end of each segment gives a small class activity. Then class attention transfers to classroom teacher and he/she should have good skills to facilitate class activity including discussion, calculation, practical and a particular daily life experience. After this activity, students gains some knowledge and BLOSSOMS module resumes for next segment. This iterative process continues until the module is over [8].

Blended learning is challenging for the teacher due to the modification in responsibility and due to a sense of danger that teachers may get stuck in the role of just giving technical advice while e-learning is highly motivating for the students, especially for shy students, without being a boredom for those who are achieving well in the more traditional school learning environments [9].

Teachers are interested in using blended learning for the following reasons

(1) to improve the his/her professional profile, and
(2) to achieve learning benefits facilitated by Information Communication Technology (ICT) but in perspective of school culture otherwise they are strongly connected to the established student examination system [10].

4 Teaching Competition

Government of the Punjab initiated a grand youth festival 2012; consisting number of events and competitions related to various fields of life including sports, agriculture, health, art & craft, education, IT and engineering. It was planned to promote blended learning skills using BLOSSOMS pedagogy. Young teachers have passion for innovative teaching skills and love to teach under the shadow of experienced BLOSSOMS teachers, such as faculty of MIT, Virtual University (VU) of Pakistan, Quaid-i-Azam University etc.

This competition was focused on the promotion of blended learning approach by using BLOSSOMS pedagogy among the young teachers to enhance their teaching skills with following objectives.

- Promotion of BLOSSOMS pedagogy
- Increase in the demand of BLOSSOMS video modules
- Awareness of skills for hosting virtual teacher
- Exhibit the experience to conduct the class activity
- Ability to involve the class
- Create model videos to understand the BLOSSOMS pedagogy

Over 120 thousands promotional emails about this competition were sent to young teachers having content about BLOSSOMS, its pedagogy and topics. Many hundred posters were made presented on main notice boards of institutes. Management offered teachers to register themselves for a certain BLOSSOMS topic. Almost 300 contestants were registered. Event management announced to send the reply of following questions by email as first level evaluation.

> Q1. How many segments in selected video topic?
> Q2. Write down question/class activity of each segment?
> Q3. Write down the learning outcomes of each question mentioned above?
> Q4. What materials, if any, will students need for the in-class exercises for each segment?

Justification of first level evaluation was to shortlist the serious contestants must have exposure of BLOSSOMS pedagogy by giving answers to above mentioned questions. Sixty contestants replied and selected for next level. Contestant's minimum qualification was graduation or to be the student of graduation degree and age was less than 35 years. On the request of event management, three prominent educationists accepted to become jury members. A few groups of high school students were selected as active learners Jury had a right to request the contestant to host one or two segments of BLOSSOMS video module for competition. As per BLOSSOMS pedagogy, contestant performed as class teacher. Thirty eight contestants hosted/ presented BLOSSOMS topics. Jury evaluated the performance as per BLOSSOMS concept [11, 12].

The contestant, who got top position, carried out class discussion during the first break. She demonstrated experiment in second break. She tried to involve the students in both sessions and got the success. i-e true spirit of BLOSSOMS. The contestants, who got second and third positions used class discussions and quoted examples of similar scenarios to facilitate the answer of BLOSSOMS teacher.

5 Discussion:

Discussion started with following quotation

> *To learn without thinking is fruitless; To think without learning is dangerous.*
> Confucius

Contestants agreed on the importance of e-learning such as implementation of BLOSSOMS in developing countries as an enabler for economic development and prosperity [13]. The major objective of blended learning is to refine the quality of teaching in classroom [14]. A suitable blend of online, offline resources and class teacher resulted to offer the best expectation. The ratio of the blend is measured by an analysis of the range and nature of the problems faced by learners [15]. One school of thought believes that learner-centered development of blended learning, the choices of what and when to blend will increasingly be manipulated and controlled by learners rather than by the teachers. In this way, students will involve and operate blends that fit their needs and preferences [16]. On the other hand, research results indicate that blended learning approach is more effective than the exclusively online learning approach [17]. While some teachers feel a sense of danger that teachers may get fixed in the role of just giving technical advice [2]. It is a real challenge of addressing tensions such as lack of training, time to explore and incentives for innovations, between professional identity and pedagogical reform is a complicated issue [18].

6 Lesson Learned

There are following few lessons were learned from blended learning teaching competition for future reference.

a) All BLOSSOMS partner countries may conduct such type of teaching contests for the promotion of BLOSSOMS pedagogy with thrill and competition.

b) Competition recorded performances which could be used as training asset for classroom teacher that how to use these BLOSSOMS video module. Web-based teacher trainings are very effective for mass level [19].

c) Teachers and learner should know the difference between video lecture and BLOSSOMS video module.

d) While hosting a BLOSSOMS module, classroom teacher should follow the sequence of segments. Each segment has its own learning outcomes. Students might be confused on disordering the segments by classroom teacher.

e) With respect to BLOSSOMS, virtual and classroom teachers must be on same page means that they must have same teaching goals. Their all efforts lead towards common learning outcomes. All blended learning resources must be cohesive [20].

f) Most of BLOSSOMS video modules fall in blended Problem Based Learning (PBL). Therefore, classroom teacher and students should be familiar with blended PBL [21]

g) The self-rating technique, utilizing video replay could be an effective method for modifying teacher performance to some extent. Teachers who employed this method significantly out-performed teachers from all levels who did not use the self-rating instrument and consistently improved their performance from video to video [22].

h) There should be tremendous promotion required to aware the difference between self-learning video lecture and BLOSSOMS pedagogy

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Figure 1: Poster of Blended Learning Teaching Competition

Figure 2: Judges (Dr. Naveed A. Malik & Dr. Sonia)

Figure 3: Zille Huma is demonstrating chemical reaction

Figure 4: Zille Huma from Garrison School System got First Position. She is performing on BLOSSOMS topic Recognizing Chemical Reactions

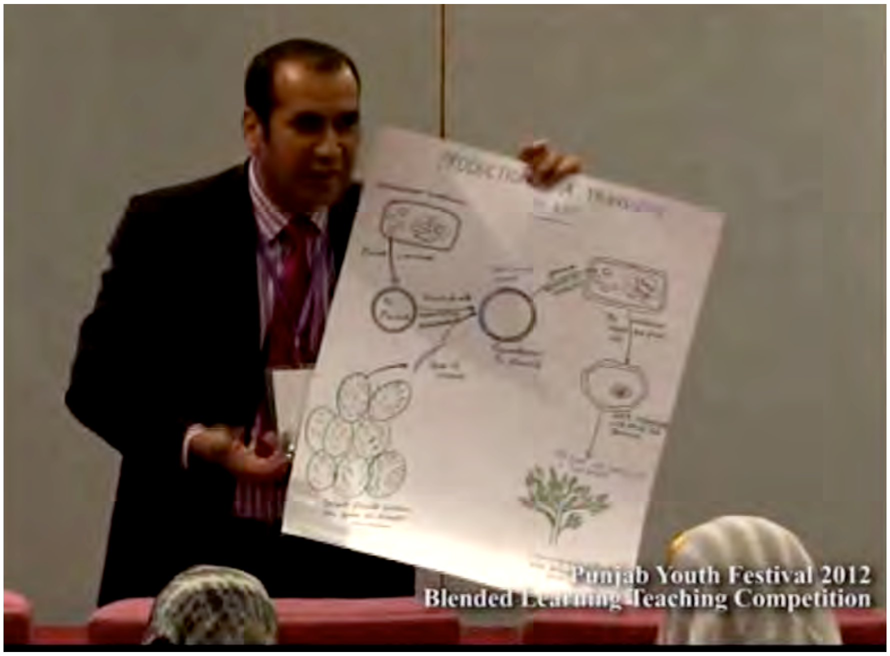

Figure 5: Muhammad Aslam Shahzad from Aitchison College Lahore got Second Position is performing on BLOSSOMS topic Biotechnology: Can It Help in Making the Desert Green?

Figure 6: Naqsh-e-Mansoor from Institute of Advanced Materials, Bahauddin Zakariya University is performing on BLOSSOMS topic Recognizing Chemical Reactions

Figure 7: Fazeela Yaqoob from Govt. Degree College for Women, Pindi Bhattian, District Hafizabad is performing on BLOSSOMS topic Geologic Time: The Ticking of Our Planet′s 4.6 Billion Year Clock

Figure 8: Kalsoom Sehar from Garrison School System is performing on BLOSSOMS topic Blood: The Stuff of Life

Remote Mentoring Young Females in STEM through MAGIC

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Abstract

The limited representation of women in STEM workforce is a concerning national issue. It has been found that the gender stratification is not due to the lack of talent amongst young females, but due to the lack of access to female role models. To this end, "remote mentoring" is an effective way to offer nation-wide personalized STEM mentoring to young females from all segments of the society. In this paper, we introduce MAGIC, an organization dedicated to mentoring young females in STEM through remote methods. We conduct a retrospective study of MAGIC's formative years and present our experience in remotely establishing 23 highly tailored mentor-mentee pairs. We provide several key findings on STEM remote mentoring, such as popular communication tools, frequently sought STEM skills among girls, and projects that could be accomplished through remote mentoring. Furthermore, we present key challenges faced by mentors and mentees, notable outcomes, and lessons learnt about remote mentoring.

1. Introduction

Despite nation-wide efforts to improve women empowerment and equality, women represent only 24% of the science, technology, engineering, and mathematics (STEM) workforce in the United States [1]. This gender stratification and limited participation is not due to the lack of talent amongst girls, but due to the discouraging societal attitudes and unique challenges a girl faces in the formative stages of her life [2, 3]. It is thus imperative to establish a nation-wide mentoring system that engages, motivates, and inspires [4] young females toward STEM subjects in a personalized manner. To this end, we systematically explore a "remote mentoring" approach to STEM mentoring, wherein the "mentee", the girl receives mentoring services using telecommunications and internet technologies. Due to the ubiquitous nature of technology, remote mentoring offers the following advantages over traditional face-to-face mentoring:

- Accessibility: Remote mentoring allows reaching out to girls located in those remote regions that are technologically advanced but lack access to women role models [5, 6] and mentoring resources.
- Personalization: A successful mentor-mentee relationship is highly tailored; both parties should be able to establish a common ground in terms of interests and values, and the mentor must possess certain qualities that the mentee aspires to emulate. The odds of finding a "matching" mentor drastically improve if geographic location is not a constraint as in the case of remote mentoring.
- Efficiency: Traditional mentoring is expensive; it involves scheduling face-to-face meetings, planning and reserving a suitable venue, and commuting to the venue. On the other hand, remote mentoring is location independent, and hence it eliminates the commute time and cost involved in traditional mentoring. Additionally, remote mentoring offers flexibility in scheduling meetings.

Therefore, we believe that remote mentoring is the only way to scale nationwide and offer personalized STEM mentoring to girls from all segments of the society.

In this paper, we introduce our remote mentoring based organization, Get *More Active Girls in Computing* (GetMAGIC or MAGIC for short)[7], founded in 2008. MAGIC (http://getmagic.org/) is a non-profit organization dedicated to encouraging young females to pursue STEM academic degrees and careers. MAGIC acts as a nationwide matching bridge between girls who are interested in STEM topics and women with successful technology and computing careers. In this study, we present the first data on remote mentoring of young females in STEM. A five-year retrospective statistical analysis of remote mentoring interactions indicates that it is possible to achieve personalization and accessibility through remote mentoring. We have established mentoring relationships across at least seven US states and mentored 23 girls from three different types of schools having different levels of expectations from the mentoring experience. The girls were given opportunities to develop a diverse set of STEM skills and work on a variety of STEM projects through remote mentoring. Some key results include:

- Skype and Google Hangout are the most popular communication tools used by 39% and 21% of the mentor-mentee pairs, respectively.
- While MAGIC aims to mentor girls in a large variety of STEM fields, about 80% of the mentees choose to work on computer programming based projects, involving computation and game design. An explanation to this skewed distribution is that majority of the mentors possess a strong background in computer science.
- Mentees learn four types of STEM skills through remote mentoring: programming languages, (42%), topic-based knowledge (31%), creative tools (18%), and Web development (9%).
- Mentors and mentees perceive different sets of challenges in remote mentoring. While mentees report time management and logistics as main hurdles, mentors identify the lack of face-to-face interaction and STEM concept delivery as main challenges.
- Overall, the most notable impact on the mentees is observed with respect to building skills and confidence, improving scientific visibility, and piquing interest in career growth.

These results collectively help to understand the desirable practices in remote mentoring, assess the interests of young females, recruit suitable mentors, and design remote programs accordingly.

2. Related Organizations and Studies

MAGIC is inspired by several organizations that continue to have a significant impact on society by supporting women and minorities. MentorNet[8], founded in 1997, is a STEM e-mentoring organization that aims to increase the representation of women in scientific and technical fields by using a dynamic mentoring network. Iridescent[9], a non-profit organization to encourage girls to pursue technology entrepreneurship, organizes a 12-week program that matches each mentor with multiple mentees to assist them in designing mobile phone applications that are finally pitched to real venture capitalists. Although this program is primarily face-to-face, the organization is exploring web technologies for its expansion. In several other organizations, such as Big Sisters[10], e-mails are an important facet of the mentor-mentee relationship building. Girls Who Code[11] is another recent effort in encouraging girls to pursue computer science using face-to-face teaching and mentoring sessions. Amidst these organizations, MAGIC is unique in two significant ways. First, we mentor teenaged females, who require more consideration, compassion, and caution than adults do. Second, we conduct long-term systematic mentoring instead of unstructured, ad hoc sessions. In addition, the program is highly personalized for each mentee. The mentor facilitates the mentee in discovering her specific interests, learning STEM skills, and gaining hands-on experience.

There are very few data-driven studies on remote mentoring children and teenagers. Brown and Dexter [12] conducted a two-year retrospective study of one-on-one remote mentoring interactions between 300 elementary school students and 100 business professionals. The objective of the program is to assist students to write more and make fewer mistakes, and develop computer skills. Each mentor-mentee pair used e-mail programs and MS Office Word, and conducted weekly writing activities on a variety of topics. The key findings of the study were that successful e-mentoring required enthusiastic and committed mentors, personal connection between mentor and mentee, technical support, a steering committee, and a smaller setup. This in turn would lead to the development of social, communication, and academic writing skills among students.

It has been found that gender determines mentoring outcomes [13], and recently several studies have focused on same sex mentoring based on the traditional face-to-face model:

- Spencer and Liang [5] conducted an analysis of 12 female relationships, focusing on healthy psychological development and emotional intimacy. The pairs were based in the greater Boston area and were established through Big Sisters association. The study conducted qualitative interviews with mentors aged 28-55 and mentees aged 13-17, and empirical analysis of their 2.5 - 11 yr. long relationships. The main findings were that mentees felt engaged, experienced authentic emotional support, developed new skills, gained confidence, and found companions. The study recommends that mentoring programs should prioritize emotional support over instrumental support.
- Tyler-Wood et al. [14] piloted an analysis of an NSF funded five-year mentoring program in environmental science and related careers. The mentors were female high school students, and the mentees were 32 elementary school students from a community in North Texas. Some adult mentors served as core mentors to oversee the program activities. The authors conducted a survey-based study on the short and long term impact of students' perceptions of STEM careers. It was observed that the participants made significantly higher gains in academic scores, and a follow up study with 14 mentees showed positive impacts on their perceptions after six years.
- Khoja et al. [2] conducted a retrospective study on a four-week computer science camp attended by middle school girls. The camp focused on exposing girls to computer science field and changing their perception of computer science. The girls worked on Alice, Lego, and social media projects and filled out a daily evaluation survey. The camp helped the girls to develop better attitudes toward computers and computer scientists, and to develop self-confidence and technical skills.

Additionally, other non-empirical studies provide evidence that mentoring is perceived positively by youth as well as adults[15]. Similar to existing studies, we focus on mentoring young females [5, 15, 16], particularly in STEM [6, 14, 17], using remote technologies [12, 18]. However, our study differs in that it conglomerates young females, STEM, and remote mentoring, and it provides the first empirical data-driven evidence of associated findings.

3. Organizational Setting: MAGIC

MAGIC was founded by a small number of highly dedicated women, who are committed to encouraging more girls to consider STEM careers. MAGIC is in its fifth year, and continues to be administrated by a small board of directors who share the same passion for motivating girls into STEM. The organizational structure of GetMAGIC is flat, flexible, and distributed. At the center, MAGIC contains a core team comprised of a handful of members who oversee the day-to-day operations and make strategic decisions. The MAGIC board has six members who meet quarterly to discuss the strategic and long-term growth of the organization, and provide innovative ideas to overcome challenges. Furthermore, MAGIC attributes its success to the mentors who are women volunteers with successful STEM careers. Each mentor is recruited through a rigorous selection process and is responsible to offer committed mentoring services. All mentors meet with each other on a monthly basis to share successes as well as challenges and offer advice to each other.

MAGIC advocates and practices one-on-one mentoring. This allows the mentors to provide the necessary attention required to teach and delve into the nuances of STEM topics, and to tailor the projects and discussions to the mentee's interests. MAGIC establishes each mentor-mentee pair with an objective to maximize successful outcomes. The matching is performed based on several factors including the mentee's interests and maturity level, e.g., the ability to handle remote mentoring, schedules and availability of mentor and mentee, expertise of mentor, and maturity level of mentor especially in case of socio-economically underprivileged mentee. Each mentoring relationship officially lasts for four to seven months and culminates in a final project. At the end, each mentee receives the opportunity to present her project in the final MAGIC meeting held in one of the partner schools. Some noteworthy final projects include personal website development, mobile phone application programming, Google SketchUp based building design, Tic-tac-toe game design, science fair experiment design, etc. On numerous occasions, these projects have inspired mentees to consider STEM as an attractive career option. Furthermore, the mentors find it very rewarding to watch a young female grasp a considerable amount of technical material in a short span of time.

4. Methodology

We collected data on remote mentoring over the course of five years (2008-2013). The information about the mentors and the mentess was collected at the time of recruitment and interviewing. The information about the schools was collected when the partnership was established. The information about the mentor-mentee pairs was collected at several points during the MAGIC mentoring cycle where the core team communicated with the mentees and mentors on an individual basis. The information was updated every time the mentee or the mentor chose to inform or consult the core mentors about a challenging issue. All the information was originally collected by the core team in a narrative fashion, and was anonymized before sharing with the key investigators of this study. Overall, we collected data on 23 mentor-mentee pairs, comprising 16 remote mentors and 23 mentees from 12 participating schools, as shown in Table 1.

Table 1. MAGIC Data used for analysis

Entity	**Total**	**Information**
MAGIC Remote Mentors	16	Highest earned academic degree, background, location, motivation to join MAGIC, number of years with MAGIC
Participating Schools	12	Location, public/private, number of years with MAGIC
MAGIC Mentees	23	School, grade, year, motivation to join MAGIC
MAGIC Pairs (Mentor-Mentee)	23	Basis of match, STEM Topics learnt, projects accomplished, communication and technological tools used, challenges faced by mentor and mentee, impact on mentor and mentee

With this data, we reported and computed several results and findings from MAGIC's formative five years. We provided a summary of the mentors including a quantitative distribution of academic degrees, backgrounds, location, and motivation to offer their services as remote mentors. We also provided the distribution of school types, mentees' grades, and mentee's motivation to join MAGIC. We also analyzed the evolution of MAGIC workforce over the past few years. More importantly, we did an in-depth analysis of the MAGIC pairs' information. We identified the top tool choices amongst mentors and mentees, most popular STEM topics learnt during remote mentoring, and some sample projects that could be accomplished remotely. We used the traditional qualitative analysis technique of coding to identify themes from narrative texts to identify the top challenges and impact on mentors and mentees. Finally, we synthesized the results to draw collective implications for remote mentoring.

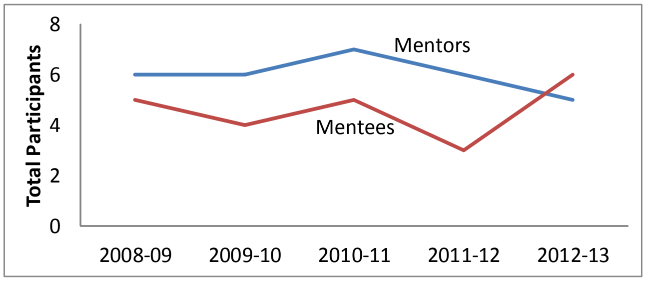

Figure 1 MAGIC Workforce Evolution for Remote Mentoring

5. Results

5.1 MAGIC Mentors and Mentees

In the past five years, MAGIC facilitated 16 women in offering their remote mentoring services to 23 young females. Figure 1 shows the evolution of MAGIC in the past few years. The red line represents the participating mentees, and the blue line represents all the recruited and active mentors in a given year. The mentors are spread across seven states in the US, with majority of them located in California and Massachusetts, as shown in Figure 2a. The highest academic degrees, finished or in progress, are nine doctorates, five masters, and two bachelors. The mentors come from a variety of STEM backgrounds (see Figure 2b) including computer science, information science, information technology, ocean engineering, astronomy, human computer interaction, robotics, and economics. During recruitment, the candidates expressed strong interest in inspiring more girls to pursue STEM and giving back to the society and scientific community. Though some cited positive personal experiences with a mentor and how that influenced their academic and professional lives, several expressed the gender-specific prejudices faced when growing up.

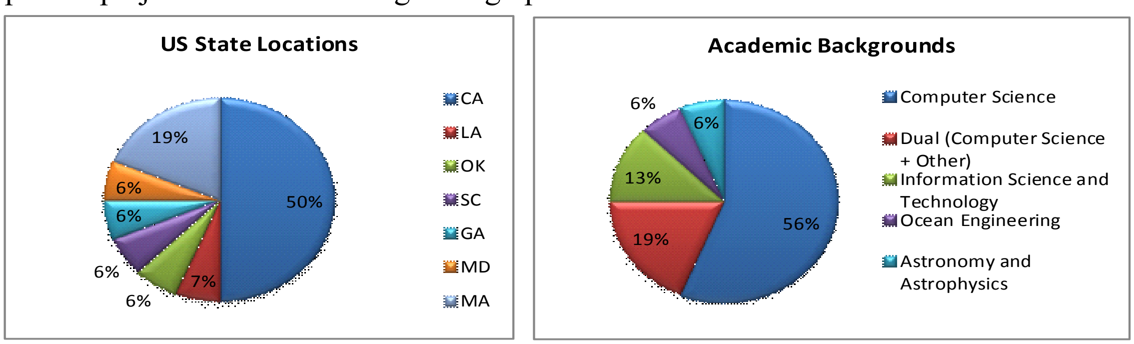

Figure 2. Information on 16 mentors (a) US State Locations (b) Academic Backgrounds

As of March 2013, eight schools (five public, two private, one charter), located in California and Massachusetts, are associated with MAGIC. In addition, a few mentees belong to four other schools that are not officially associated with MAGIC but allow student-level participation. To date, MAGIC has remotely mentored 23 girls from grade 6 through pre-college level, as shown in Figure 3a. All the mentees had goals and expectations before starting the program; their goals could be categorized into three classes:

(i) General learning: Some girls started the program with open-ended learning goals, e.g., to deepen their understanding of biomedical engineering.

(ii) Specific-skills: Some mentees were very clear about the sort of skills they wanted to learn, e.g., to learn C++ for a robotics project to be undertaken the following year.

(iii) College and Career Exploration: Some girls required mentoring to prepare college applications or explore their career interests, e.g., a mentee wanted to learn about environmental engineering major and the possible college choices; another mentee was interested in learning about careers in software development.

The distribution of goals across mentees is shown in Figure 3(b).

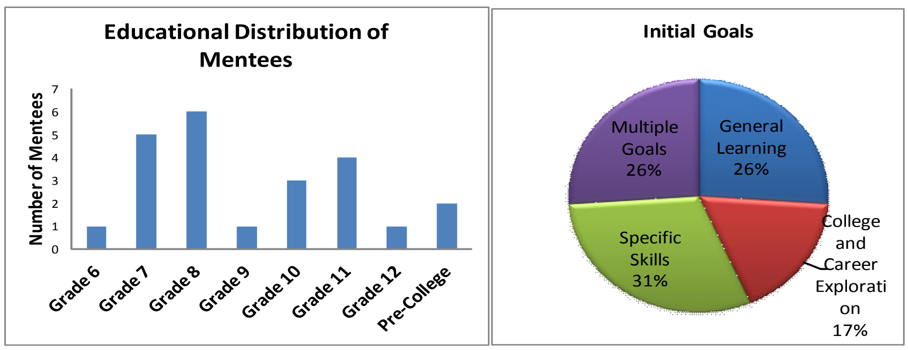

Figure 3. Information on the 23 Mentees (a) School Grade (b) Motivation to join MAGIC

5.2 Remote Mentoring Activities

During the first few meetings, the MAGIC pairs experimented with several communication methodologies before deciding to use a combination of tools that work well on the computers at both ends. Figure 4a shows the top tool choices during the past few years. In addition, all the pairs used emails for ad hoc communication; a few had the opportunity to meet with each other in-person once or twice during the course of the mentoring relationship. Figure 4b shows the skills and topics that the mentees learnt through remote mentoring sessions. The majority (42%) of the skills acquired by mentees were related to programming languages such as C and JAVA and programming tools such as Scratch and Alice. Other skills included Web development such as CSS, HTML, JavaScript, creative skills such as creating music through programs, animation in Flash, architecture and modeling, and cryptography codes, and topics such as STEM careers, biomedical engineering, electronic voting, Google maps, Excel, astronomy and space, computer networks, and science experiments.

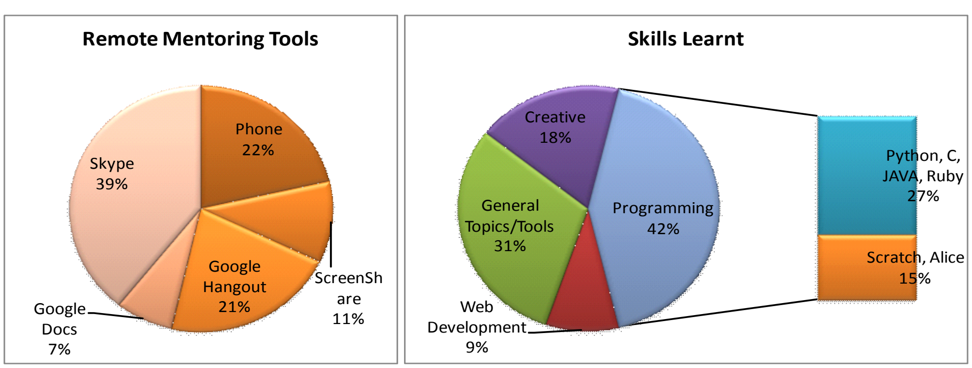

Figure 4. (a) Communication tools used for remote mentoring, (b) Skills learnt through remote mentoring

In addition to several reading assignments, the mentees completed a variety of tangible STEM projects. These projects could be classified into the following categories:

(i) Computation Projects: While learning programming languages, mentees worked on several beginner level programs requiring computations such as calculating factorials, identifying prime numbers, printing Fibonacci series, etc.

(ii) Game/Animation/Web Projects: Several mentees developed projects such as a website with Flash animations, the Tic-tac-toe game, an interactive tool to teach English alphabet to children, etc.

(iii) Non-programming Projects: Several mentees worked on projects such as interviewing and shadowing a STEM professional, preparing college applications, exploring Google SketchUp, and designing science fair experiments, and engaged in outdoor activities such as learning to use a telescope.

Each pair worked on one or multiple projects. The distribution of projects in the above-mentioned categories was 44%, 36%, and 20%, respectively.

5.3 Remote Mentoring Challenges

MAGIC mentors and mentees reported certain challenges throughout the remote interactions. Scheduling and time management were challenging for several participants. Many mentees experienced difficulty in assigning time to MAGIC assignments and projects, and reported that they remained busy with several after school activities, full time jobs, and travelling. A few reported time zone difference as a challenge. Some mentors reported that the mentee was involved in too many activities to be able to manage her time efficiently.

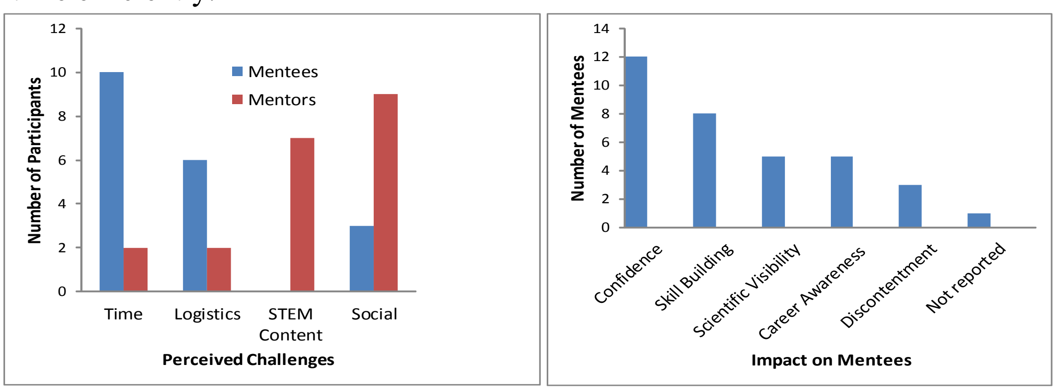

Figure 5 (a) Challenges faced during remote mentoring (b) Impact vs. Number of Mentees

Remote setting logistics were another challenge reported by many, e.g., software version and operating system (Mac vs. Windows) compatibility and lack of infrastructure (webcam, headphones, etc.). Several mentors reported teaching and remote delivery of STEM content as a huge challenge. In a few relationships the mentor did not have the exact skills that the mentee wanted to learn. Moreover, there is a lack of material on teaching advanced programming language to children. Some mentors found it difficult to decide on a particular topic, e.g., Ruby vs. JAVA. Few mentees chose over-ambitious projects for their age, and thus the mentors found it challenging to explain the intricate STEM concepts remotely. Many participants faced social and interpersonal challenges, e.g., lack of family support, miscommunication, presence of international accents, lack of mentee' continued interest, lack of response from the mentee, etc. In addition, some mentors reported difficulty in drawing a line between instructing and mentoring, and in connecting with an introverted mentee. Figure 5a illustrates the type of challenges faced against the number of participants. At least seven mentees and seven mentors reported no challenges throughout the interactions. All the pairs successfully dealt with the challenges on their own or with support from the core team, e.g., the mentee started using a planner in one case and the mentor started creating power point slides to improve communication of complicated topics.

5.4 Impact of MAGIC Mentoring on Mentors and Mentees

Impact on Mentees: Overall, 12 mentees reported feeling more confident about their skills and personal attributes as a result of the MAGIC interactions. They enjoyed the experience and valued the invested time; eight mentees felt a significant improvement in their STEM skills, resulting from projects such as writing computer programs, developing websites, and learning tools. Some mentees had the opportunity to gain public visibility through the mentoring experience, e.g., six got the opportunity to attend the Grace Hopper Conference for Women in Computing: four as panel members and two as poster presenters; two mentees were winners of the 2013 NCWIT Aspirations Bay Award. A mentee reported that she showcased her website to her family living abroad. At least five mentees reported that they gained significant improvement in career awareness and advancement; one received a reference letter from her mentor for high school admission; two became aware of career choices: space and environmental engineering; one mentee got an internship opportunity as a result of a MAGIC site visit. However, three mentees reported discontent due to the remote aspect. They wished they had more time to devote to MAGIC and complained of their mentors' frequent travels. Also, one mentee did not report any impact due to premature termination. A detailed distribution of the impact on mentees is shown in Figure 5b.

Impact on Mentors: The majority of the mentors reported a positive and educational experience and enjoyed their relationship with the young mentees. At least three mentors expressed close interest in mentoring the following year, six mentors offered assistance in MAGIC core and administrative activities such as recruitment, publicizing, and sundry items and expressed interest in becoming board members. However, three mentors did not find the relationship rewarding due to the lack of mentees' commitment and enthusiasm.

6. Discussion

6.1 Organizational Outcomes

Accessibility: Most of our mentors are located in California and Massachusetts because a majority of the MAGIC core and board members reside in these two states. Nevertheless, mentors from five other states have also been recruited. While the mentees are also located in the two headquarter states, MAGIC has created associations with three different types of schools in order to reach out to different societal sections. Even in its formative years, MAGIC has matched mentees and mentors across seven different US states. Interestingly, several pairs are east-coast/west-coast pairs.

Personalization: Our mentees not only come from different familial backgrounds, but also have a diverse set of expectations from MAGIC, equally split among skill building, topic-based learning, and career exploration. In the past five years, MAGIC ensured that each mentee is associated with the most appropriate mentor, and offered tailored services to the mentees, wherein they learnt a variety of STEM skills (programming, creative, Web, conceptual) and worked on a variety of projects (technical and interpersonal).

Plan for Growth: MAGIC plans to expand its program to tens of schools and hundreds of mentees in the next five years. The biggest challenge would be replicating the energy and dedication of the small board of directors and this is precisely the reason that we have intentionally decided to stay small for the first few years. We plan to grow by partnering with one or two schools every year, or by adding more mentees in a school, or by carefully expanding geographically. Presently, MAGIC has a bank of about 40 mentors, not all of who actively mentor during each session. The MAGIC board has been brainstorming different ways to increase the mentor bank while retaining the organization's extremely high bar for mentors. Some ideas include partnerships with universities, national labs, and companies, possibility of university students getting credit for mentoring hours, shorter mentoring sessions in an effort to reduce the number of hours a mentor needs to commit to, etc.

6.2 Lessons learnt about Remote Mentoring

Based on our retrospective analysis, we can draw several conclusions on remote mentoring young females in STEM. The following key findings will help any organization when establishing and implementing the program, recruiting mentors, and above all understanding the general needs of girls aspiring to be STEM graduates and professionals.

- Skype, Google Hangout, and phone are the popular and feasible choices for remote communications endorsed by a majority of our mentor-mentee pairs.
- Programming, topic-based learning, and creative skills (e.g., music, animation software) are the top learning choices of our mentees. These represent the type of skills that could be learnt successfully via remote mentoring. While the big picture goal of MAGIC is to target a variety of STEM fields, the current skill palette is largely dominated by programming languages (Figure 4b) because a majority of our current mentors have strong backgrounds in computer science (Figure 2b). Additionally, the founding members of MAGIC possess similar backgrounds.
- Computational and game projects, and shadowing activities, were the popular project choices among our mentees. These represent the types of finished deliverables that could be accomplished through remote mentoring.
- We find that the mentors and mentees perceived different set of challenges. While the girls were concerned about time management and logistics, the mentors' main concerns were about the delivery of content and social challenges. It is thus important to educate both sides to collectively address the challenges. However, these challenges do not necessarily indicate failures, and were effectively and collaboratively addressed by the MAGIC team, leading to largely positive outcomes.
- Above all, remote mentoring made a positive impact on the mentees' lives, building skills and self-confidence. In addition, several mentees gained scientific visibility and significant career awareness.

7. Conclusions and Future Work

A recent Harvard Business Review study[19] suggests that more women in the workforce could raise GDP by 5%. The statistics call for nationwide efforts to fix the problem of the dearth of women in STEM education and workforce. In this paper, we introduce our unique organization, MAGIC, which remotely yet closely engages girls to pursue interests in the STEM fields. MAGIC aims to facilitate highly personalized services to young females, and hence the most pressing concern is recruiting mentors and mentees who have the passion, time, and energy to help realize the vision of MAGIC. Through this study, we have provided a data-driven perception on remote mentoring young females in STEM. One limitation of this study was that a majority of the mentoring projects were focused on computer programming due to the backgrounds of our current mentors. Hence, this study might not have provided a balanced analysis of remote mentoring in the STEM fields in general. To address this, we plan to continue our efforts in recruiting mentors with expertise in other STEM fields. We also plan to conduct the study with increased numbers of pairs, diversify the mentees' locations and interests, and study correlation between the challenges faced and the mentoring outcomes.

7. Acknowledgements

We sincerely thank our sponsors (Google, Teradata, and personal donors), participating schools, MAGIC mentors, MAGIC mentees, and mentees' parents. Additionally, we thank the NIH Fellows Editorial Board for their assistance in editing this manuscript.

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BLOSSOMS – Mini
A BLOSSOMS Experiment for Public and Private Schools in Pakistan

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Abstract
This paper explores the implementation of BLOSOMS-Mini at a local school in Pakistan as a case study. Inspired by the MIT-BLOSSOMS project, similar but shorter videos on theoretical subjects taught in Pakistan's schools were prepared by teachers. The objective was to counter one of the most important issues faced by teachers in classroom i.e. generation and retention of subject interest in the students. The videos were then used as aid in the classroom and student learning was tested. It was observed that these short videos proved to be extremely helpful in improving the standard of learning in the classroom. On the students side, interest level and learning improved while on the teachers side, the preparation of these videos increased their knowledge about the subject also. In a country, where teacher training is very low, these videos, if implemented at government level, can bring about a significant change in the education system. The paper lays down how the video-based learning system i.e. the Mini-BLOSSOMS project can help in the achievement of long term education targets of Pakistan.

Education in Pakistan: General Overview

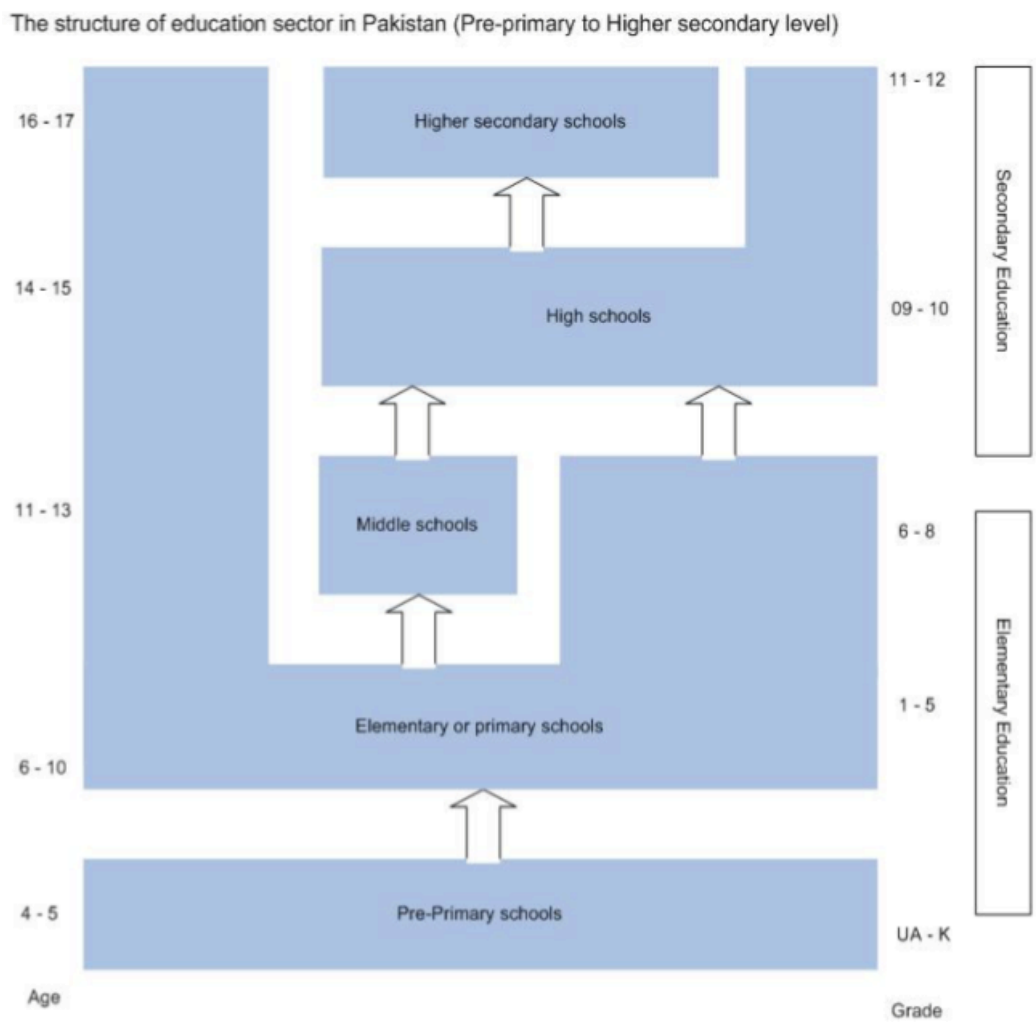
Education plays a key role in the development of any economy. International statistics display that educated populations have a direct positive relationship with high economic growth rates, enhanced labour productivity, social prosperity and sustainable development. More importantly, equalization of educational levels within a country is an important factor in the elimination of regional, gender and class inequalities. It battles poverty by reducing unemployment, setting decent practices for women's participation in the work environment and providing guidance regarding financial expenditures towards most beneficial use.

Like many developing countries, Pakistan has not progressed adequately in the field of education. With an adult literacy of only 57%, a large part of its adult population is unable to read or write. School enrolments are very low and drop out rates are too high. The budgetary allocation for education has remained about 2% of GDP for the past decade, with a high proportion being spent on heads such as salaries, which leaves a small amount for teacher training, curriculum development and increase in school facilities.

On the Education Development Index (EDI), Pakistan lies at the bottom with India, in the low EDI group. The Global Competitiveness Index (GCI) also shows Pakistan's weak performance in the areas of health and education, when compared with other countries of the region.

Pakistan's Education Structure:

The structure of the education sector of Pakistan (pre-primary to higher secondary) is illustrated below:



The most striking feature of the above-presented system is its inherent inequalities. There are parallel streams of primary and secondary schooling, which are further divided in public and private sectors. These sectors cater to different socioeconomic classes in the country.

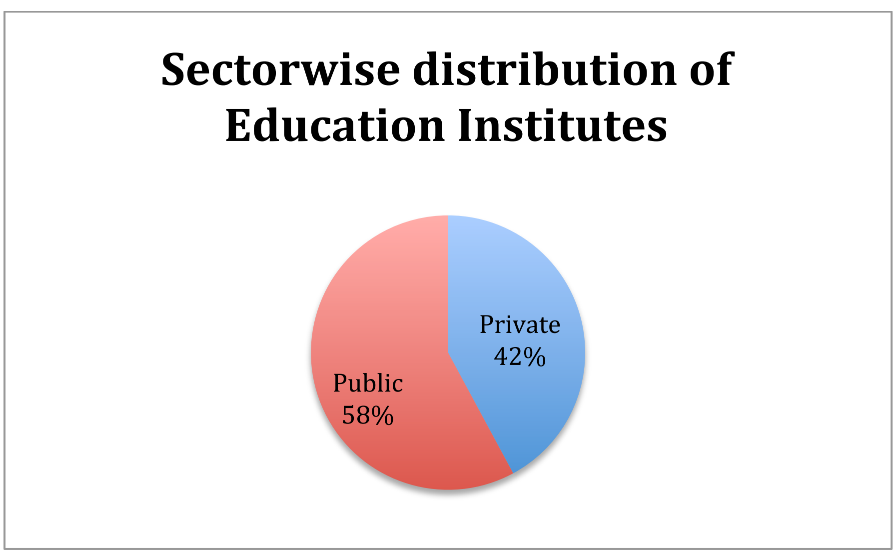
The majority of the children, residing mainly in rural and semi-urban areas and belonging to the lower to middle classes, attend public schools which offer free matriculate system education and face issues like shortage & absence of teachers, weak infrastructure and lack of learning materials.

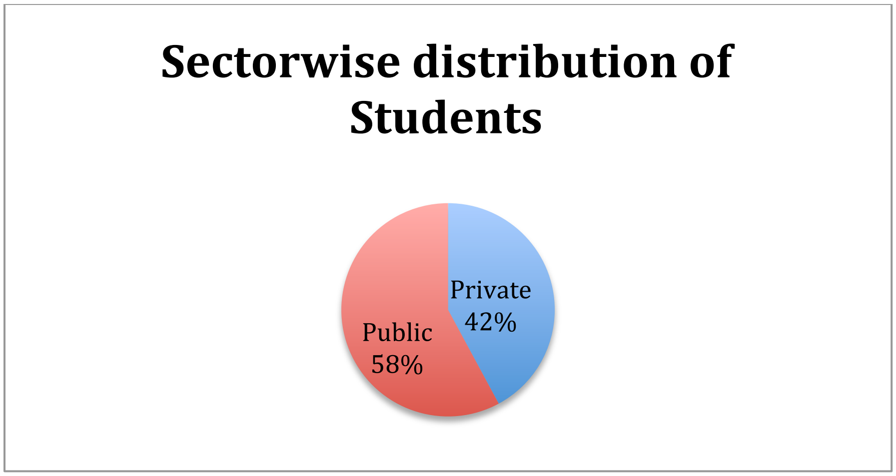
On the other hand, children of upper-middle and upper classes, residing in rich urban localities, mostly attend high cost private schools which offer both local (matriculate) as well as foreign examination systems (e.g. O and A levels). These schools are staffed with qualified and trained teachers, well-equipped classrooms, all essential facilities and good quality, often imported, imported teaching and learning materials.

Education in Pakistan: Statistical Overview

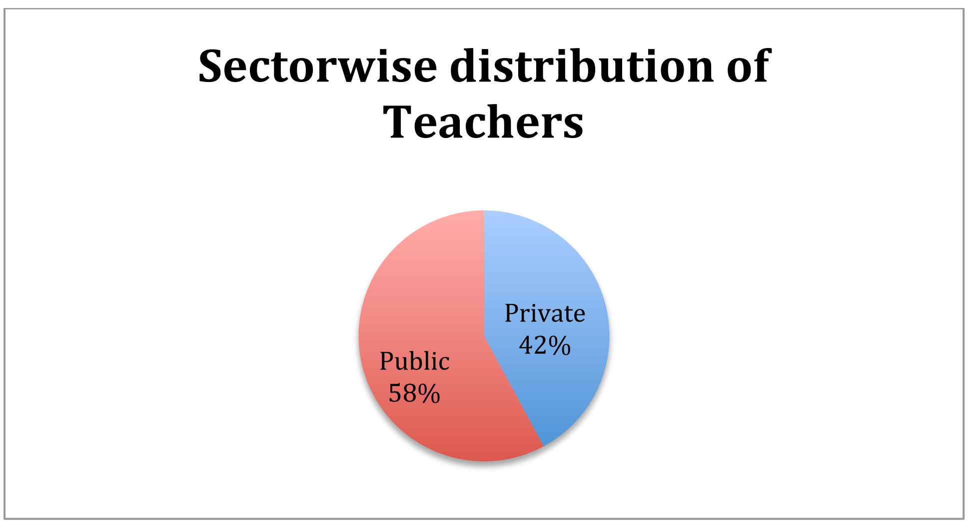
The education system of Pakistan is comprised of almost 0.27 million institutions and is facilitating around 41 million students with the help of approximately 1.5 million teachers. The system is composed of 194,151 public institutions and 76,674 private institutions. The sector wise distribution of educational institution in percentages is shown in figure below.

The public sector is serving 26.5 million students to complete their education while the remaining 14 million students are in private sector of education. The sector wise distribution of enrolment in percentages is reflected in figure below.





Comparing these two sectors of education in terms of teaching staff, we find that 57.88% of teachers are providing their services to public institutions whilst 42.12% are employed by the private sector.



Data from 2010-2011 shows that the overall public sector education system is using services of approx. 0.8 million teachers while in 2008-2009 the system had the services of 0.7 million teachers, indicating that over this time period, 0.1 million more teachers are added to the system.

Two Major Issues related to education in Pakistan

1) Quality of teachers

It is accepted by all stakeholders that the quality of teachers in the public sector is unsatisfactory. Poor quality of teachers in the system is due to the mutations in governance, an outdated pre-service training structure and a less than satisfactory in service training regime. Presence of incompetence in such a huge quantity and infusion of malpractices in the profession have not only caused adverse affects on students but also have had a negative effect on the high status of teachers in the eastern culture. Teaching has become the employment of last resort of most educated young persons, especially males**.**

According to the National Education Policy (2009), reform is required in all areas: pre-service training and standardization of qualifications; professional development; teacher remuneration, career progression and status; and governance and management of the teaching workforce.

2) Curriculum

Another common observation in Pakistani schools is that classroom teachers do not use the curriculum. Their focus is on one single textbook that is assigned to them for the subject. Even assessments are based on this textbook and not the curriculum.

The curriculum also does not cater to the primary need of student i.e. generating interest of the subject. Due to this lacking, most of the students follow the rote learning approach without understanding the basic concepts of the subject.

The teachers also have a routine conventional way of teaching from the same book for years and years without creating new unorthodox and interest generating methods.

Training of Teachers

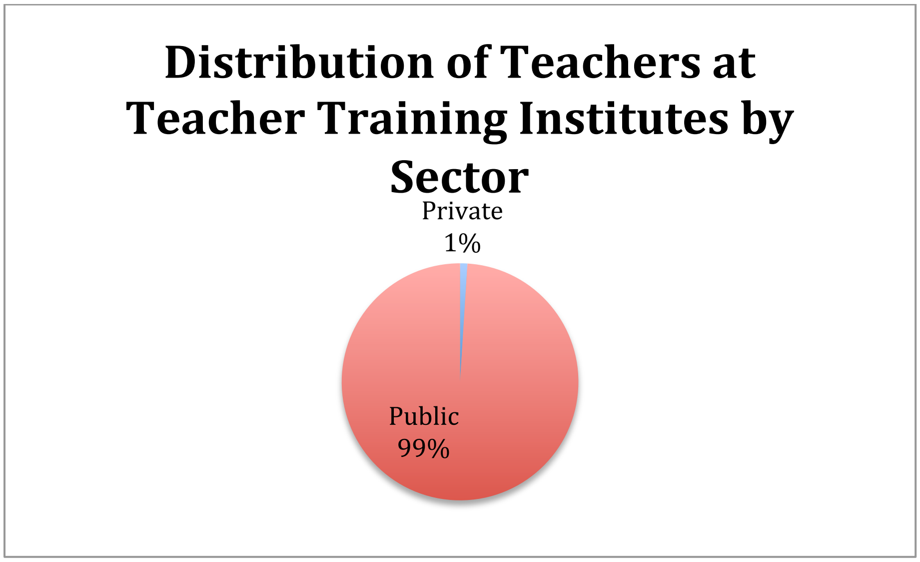
The above problems can be addressed partially with some proactive work in the domain of teacher training.

If proper policies and procedures are designed and implemented to equip teachers with the knowledge, attitudes, behaviors and skills they require to perform their tasks effectively in the classroom, school and the community, they would translate into high learning achievements of students.

But unfortunately, teacher training is also a neglected area in Pakistan. There are only 184 teachers training institutions, of which 151 (82%) are in the public sector, whereas 33 (18%) are in the private sector.

The total enrolment at teachers training institutions is 0.679 million of which 0.674

million (99%) are in public sector, whereas, 0.005 million (1%) are in private sector.



Effects of above problems

The ultimate test of quality of education relies on the learning achievements of school children.

In 2011, a study was conducted by the 'Aga Khan University's Institute for Educational Development' in Pakistan. It covered 196 schools and over 6,000 students from classes IV and V across several districts of Sindh. It gathered information on student populations and prevailing teaching, learning and management practices in these schools, as well as data on student learning achievements in four core subject areas i.e. Mathematics, Science, English and Social Studies.

Unsurprisingly, students were shown to be performing poorly with just 17 percent obtaining pass marks in tests. Girls performed relatively better in all subject areas as compared to boys even though they were not encouraged or provided equal opportunity to participate in classroom.

The study also revealed that only 56 percent of the enrolled students attended classes regularly, with the remainder either attending school intermittently or remaining absent. Moreover, 70% of primary school teachers across Sindh teach their classes for merely 15 of the 35 minutes assigned to each subject daily. Only 20 percent teach for more than 20 minutes while the remaining 10 percent offer even less than five minutes of teaching time in their classrooms.

These low learning levels are an unacceptable reality needing urgent responses from all stakeholders: households, parents, educators, civil society, industry, government, youth groups and media in a campaign mode for action oriented results.

BLOSSOMS enters the picture

BLOSSOMS is an "Open Educational Resource," a web-based collection of materials offered freely and openly for re-use in teaching, learning and research. The project is sponsored at MIT by LINC (Learning International Networks Consortium), a consortium of global educators interested in using distance and e-learning technologies to increase access to quality education worldwide.

An introduction to this initiative at the MIT-LINC conference in 2010 made me think about its implementation in Pakistan. It was heartening to know that there are plans to implement it in some schools of Punjab. Being the voluntary administrator of a small charity school in Karachi (province of Sindh), I was determined to implement it there.

The Cutchi Memon School, Karachi

The Cutchi Memon English School, Saddar, Karachi started as a Madressah in 1894. The thriving Cutchi Memon Community set it up. The inspiration for setting up of this school was drawn from the Educational and Reform Movements launched by Muslims stalwarts such as Sir Syed Ahmed Khan, Justice Syed Ameer Ali, Khan Bahadur Hassanali Effendi and many others in the late nineteenth century.

It became a lower (Middle) school in 1927 and a secondary level school in the 1960s. In 1972, the school was nationalized by the government of Pakistan. It was restored to the Cutchi Memon community in March 1999. The School is now a co-education and English medium institution. The cosmopolitan nature of this school is reflected in the present enrolment of 390 students belonging to different religions, sects, creed and races.

Being a school catering to the lower segment of the society, the students come from families who have no or very low education level. Most of the parents are illiterate and are unable to keep a check on the studies of their children. This adds to the responsibilities of teachers, who are mostly in this profession by chance, not by choice. Their lack of competence and failure to motivate students translates into an extremely low level of student achievement. Students opt for rote learning to pass their annual exams, without the understanding of subjects that are already taught with the help of an old dry curriculum.

The mini-BLOSSOMS Experiment at C.M. School

A group of young teachers were shown the Blossoms videos through the Blossoms website and were asked to provide their opinion on the video based method of teaching. Their initial reaction to Blossoms was positive but they were confused about its implementation at Cutchi Memon School. After discussion, teachers presented the following suggestions:

1) The videos already present on the BLOSSOMS website are related to practical subjects such as Physics, Mathematics, Biology etc. but there were no videos

related to purely theoretical subjects taught here such as Language, Ethics, Religion, Social Studies etc. The teachers were of the view that interest of students is low in classes of these theoretical subjects, so video modules might be helpful here.

2) The duration of most of the videos was long. Teachers suggested that if the duration of the videos can be reduced, they could serve as good starters followed by explanation given by teachers, who could refer to the video whenever required.

We concluded that a practical effort to make our own Mini-BLOSSOMS videos could be started. The teachers were then given a task to select two chapters, from textbooks of their subjects, for which they feel video aid would help students. The chapters selected by the teachers were:

1) *The Hajj – Chapter 2B from Islamic Studies for Class VIII*
   The chapter was selected because Hajj is a complex Islamic ritual and the teachers felt that they face difficulty in explaining this chapter to the students. They felt that video aid might increase student learning and also generate interest in the topic.
2) *Land and Climate of Pakistan (Section: Mountains) – Chapter 4 from Social Studies for Class VIII*
   The reason for selection of this chapter was that the teachers felt that most students are not interested in learning the names and heights of mountains etc. so visual aid might increase their interest level.

The initial script was drafted from the chapters and a senior teacher was selected to narrate the script on camera. Urdu language was selected for the Islamic Studies video while English language was used for Social Studies video. Corresponding visuals and images for both were finalized and finally the production of two videos was completed in ten days.

The next task was to test the result of video-based learning on the students of CM school. Two groups of students were selected for this experiment. Details of the groups are as follows:

1)Group A: 15 students (7 boys and 8 girls)
2)Group B: 15 students (6 boys and 9 girls)

Both the groups were taught the selected chapters in the conventional manner without any visual aid. After the lecture, they were tested about their learning outcomes with the help of a written quiz. The outcome of the quiz was that 60% students secured passing marks.

For teaching with the help of our Mini-Blossoms videos, as we had named project, two more groups of students were selected.

1)Group A: 15 students (8 boys and 7 girls)
2)Group B: 15 students (6 boys and 9 girls)

The two groups were taught the same chapters with the help of these videos. Before the formal lecture, students were introduced about the subject and the video was played. Students showed great interest in watching the video. After the video, the normal lecturing started but the teacher kept referring to the video regularly and also showed them important clips during her lecture. Test was conducted after the lecture and it was a surprise that 75% students of this group secured passing marks.

The response of teachers on teaching with video aid was also positive. They said that the video helped them in preparing the lecture and it also helped them during the class as it increased student's interest in the topic.

This basic experiment, its successful results and the overwhelming response from teachers and students encouraged us to produce more videos for the Mini-Blossoms project so that they can be implemented. Working on production of new Mini-blossoms videos for theoretical subjects has started with the help of school students, who are now learning the basic of TV production too.

It is further planned to follow the open courseware model to make all the videos available online so that anyone can benefit and also improve upon them.

The videos produced initially can be viewed at:

1)Mountains of Pakistan: https://vimeo.com/50480464
2)The Hajj: https://vimeo.com/50425119

As far as the existing BLOSSOMS videos from all over the world are concerned, the teachers plan to:

1)Screen the videos related to their subject in classroom.
2)Translate the English videos to Urdu so that they become more comprehendible for our students.
3)Use them as guides when preparing their own lectures.

Major Benefits of Mini-BLOSSOMS

1) It provides a good interesting start to the topic being topic. Students get actively engaged in viewing the video before the lecture so their initial interest is built.
2) It heightens motivation as students actually see what they are learning. Most of the times when the discussion is about something that students have not observed, this method helps them understand the topic in a better way.
3) It increases retention, as it is easy for students to remember what they saw as compared to what they heard.
4) Referring to the video during the lecture holds the student's attention throughout the lecture.
5) Students ask more questions about the discussion topic, as their visual and auditory capabilities are both at work simultaneously.
6) While creating the videos, teachers also learn a lot. Brainstorming, information gathering and knowledge sharing in the video making process improves their understanding of the topic even more. So it serves as a great tool for training of teachers.
7) Since the video can include information from multiple sources, students and teachers both learn a lot more than what is present in the textbook.
8) It is a one-time effort and videos once produced can be utilized in future even if the teacher is not available.
9) Whether it is a conventional school, a school in slum areas or a village school, Mini-BLOSSOMS can go everywhere and benefit everyone.
10) Videos once created can be improved constantly. These changes can be done keeping in view the changes in syllabus or if teachers find some new interesting information which they feel must be included.
11) Teachers can take the more difficult content from any topic and make videos around that content. These videos can become great resources for students and other teachers.

Suggestions for the MIT BLOSSOMS Project

1) Scope of the project can be expanded and theoretical subjects can also be included.
2) Ministries of Education from participating countries can be approached and they can be asked to start developing videos keeping in view their curriculum/course book for any specific class. These videos can later be made an integral part of the curriculum.
3) Since the development of the video is also an enriching exercise for teachers in terms of their learning, it is suggested that networks of teachers from different countries can be established. These networks can collectively work on developing videos with the help of a collaborative video development system.

Scope in Pakistan

The Vision 2030 for Pakistan, prepared by the recent government, aims at a high quality of life, providing equal opportunities to its citizens to reach their true potential. It is based on a plan to meet contemporary and future challenges by deploying knowledge inputs and developing human capital.

In the context of social development, it states, *"The citizen shall have greater access to quality education, as well as basic amenities like health, water and sanitation."*

According to Vision 2030, "*Education is a key driver of economic growth because of its positive linkages with employability, entrepreneurship, empowerment of women and productivity – conditions that are all conducive to building a knowledge-based productive economy where our youth are better skilled, productive and scientifically trained to compete with the fast changing global trends."*

The National Education Policy of 2009 states that:
"A well regulated system of competitive publishing of textbooks and learning materials shall be introduced."

The Mini-BLOSSOMS project has the potential to assist in achieving the above-mentioned targets by the Government of Pakistan. It can be implemented in public schools across the country to reduce teacher-training shortfalls and increase student learning.

It can prove to be a great asset for public schools in rural areas of the country where lack of facilities and lack of interest in education are major issues. With a one-time setup cost, schools in such areas can impart knowledge to their students even with the help of teachers with less formal training.

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Educational Technology and its Acceptance Level Among the Students and Teachers in Some Rural Areas

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Abstract: The benefits of educational technology have not fully reached the students and teachers particularly in the rural areas, although there has been a flurry of activities in the computerization of teaching-learning process in India. Post globalization, we have witnessed tremendous extension of educational reach. Technology has become an integral part of the teaching-learning process in the urban and semi urban areas. All the universities and colleges are being digitally connected through the National Knowledge Network (digitally), however, this expansion of e-learning and associated changes in pedagogy, are yet to percolate fully to the schools, particularly those run by the government. These schools which act as feeders to the universities and colleges make it difficult for their passed-out students to suddenly accept a radical shift in the pedagogy and other e-tools that are now widely used in higher centers of learning with the benefit of producing trained human resource to sustain the economic growth.

We have successfully conducted an experiment on e-learning in rural areas in the state of J&K under a Government of India funded project titled “VSAT enabled Mobile e-Learning Terminals (MeLTs)”. Based on a Need Assessment Survey (NAS), which was carried out in 22 districts of 6 northern states of India by 8 different institutions covering 515 schools/ colleges, 12 custom fabricated MeLTs were deployed in the various educational institutions where there was either none or limited penetration of IT enabled learning. Our group had successfully deployed 2 MeLTs in the state of J&K and demonstrated their role and impact to the stakeholders. After the deployment and delivery of e-learning with the help of the MeLTs an impact assessment survey was carried out by a third party. Here we shall present the results of this study.

*Presenting author
**At the time the experiment/ project under reference was carried out, the author was with Department of Electrical Engineering, IIT Roorkee.

1. Introduction

Making available the benefits of new technology, especially, the information and communication technology is among the “top-down millennium development goals” which were envisaged over a decade back. No doubt a lot of progress has been made in this direction; however, a herculean effort is needed to implement this more effectively particularly in the rural areas. Besides good and effective governance, access to technology has proved to be a great enabler for improved quality of life. However, such benefits have remained limited to developed countries, thus, affecting the lives of only a fraction of the world population. It is well established that socio-economic factors often tend to play a critical role in deciding who has access to technology. This in turn leads to a digital divide. India, in last two decades, has become a leader in software exports and computer related services. However, this has happened due to only a small fraction of our population. There is a vast populace, particularly, in the rural areas that still does not have access to technology and technology-enabled learning; and this is unable to contribute and therefore participate in development process. Prosperity of a country depends on the ability of how well its population can use technology, in general, and computers in particular. One may argue that the problem can be simply solved by providing computers to schools. However, it may not work in case of people who belong to the lower strata of the socio-economic ladder. It has been seen that providing computers alone to schools does not turn out to be an effective solution as there are many other enabling factors which often determine the success of such interventions (Wanchoo *et al* LINC 2010). At the same time, studies carried out by experts and researchers world over have indicated that if technology is made available to people, especially to younger population, they would learn to use it in a manner as may be suitable to their needs. Experiments such as “hole in the wall” which is a “minimally invasive” learning model conceived by Sugata Mitra and his team has demonstrated this concept by placing computers in the walls in slums and observed that soon the children had learnt to use these systems without any formal classroom or any other direct teaching being imparted. The results of this experiment indicate that irrespective of diversity in terms of ethnicity, language, gender and socio-economic status, children can learn to use computers. Clements (1999) observed that computers give children opportunities that cannot be offered in the computer less world. Children have the opportunity to complete a given task on their own, and thus, they have the chance to develop their thinking skills (Papert, 1980). One can therefore safely argue that availability of technology enabled pedagogy is essential in improving the quality and standard of education which will enable India to continue on the growth path by readying (equipped with the necessary skill sets) the large population pool in the rural segment so as to enable them to meaningfully contribute to GDP. Therefore, there is a constant need to evolve new and innovative models to reach out to this vast pool of people, and transform adversity into opportunity. This has become essential ever than before due to the increasing digital divide among the urban and rural populace although mobile telephony has been able to penetrate deeper into these pockets thereby increasing the user expectations from technology.

2. VSAT Enabled Mobile e-Learning Terminals (MeLTs):

The prime objective of the MeLTs has been to make available to the students, e-lectures and knowledge e-contents of their interest free-of-cost. By providing data connectivity in remote areas MeLTs are expected to help in reducing the digital divide between the urban and the rural areas. The need assessment survey carried out by our group established that data connectivity in most of the remote areas is either not available or it is not satisfactory (Wanchoo *et al* LINC 2010). Sparse population in many areas motivated us to go for mobile rather than stationary e-learning terminals, as the later would remain under-utilized and would invite higher initial and maintenance costs. MeLT based data connectivity have been demonstrated to be more effective and make better utilization of the investment. MeLTs can provide access to e-learning to anyone, anytime and anywhere. This would ensure standardization of quality of the contents which is pre tested/ verified and it is no longer a static closed door student teacher interaction. Nature of e-content utilized to which students were provided exposure included: Mathematics, Computer, Science, Social Sciences, Languages and Social issues.

Participatory approach was used to undertake the project. A series of workshops were organized to finalize the modus operandi for implementation of the project in consultation with network institutions. The following 10 institutions were identified as network institutions (table 1) for the project:

University Institute of Engineering & Technology, Panjab University, Chandigarh.
Sant Longowal Institute of Engineering & Technology, Longowal
National Institute of Technology, Jalandhar
HNB Garhwal University, Srinagar (Uttrakhand)
Birla Institute of Applied Sciences, Bhimtal
Rajasthan Technical University, Kota
Shri Mata Vaishno Devi University, Jammu
National Institute of Technical Teachers' Training & Research, Chandigarh
Mahatma Gandhi Central Library, IIT, Roorkee
Dharmsinh Desai University, Nadiad, Gujarat

Table 1: List of Network Institutes

Network institutions undertook a need assessment survey in their respective regions to determine the present status of technology in schools, colleges and technical institutions. After the development of prototype mobile e-learning terminal, Van based VSAT enabled mobile e-learning terminals were procured and provided to the identified ten network institutions. MeLT Vans were well equipped with 8 modes of e-learning (table 2):

DTH supported e-learning
Edusat/SIT supported e-learning
Multimedia drive supported e-learning
Internet/LAN supported e-learning
Local server/WLAN supported e-learning
Internet/WLAB supported e-learning
Local server/LAN supported e-learning
CD/DVD supported e-learning

Table 2: supported modes of e-learning

In addition, twenty computers with LAN facility and twenty chairs were provided in each van for use by the students.

3. Need Assessment Survey for MeLTs:

A need assessment survey was carried out in 515 institutions in the six states covered under the pilot to identify the areas in which the MeLTs need be deployed on the following broader parameters (table 3).

Physical access	ICT access
Teacher student ratio	Computer student ratio
Infrastructure availability	Willingness to participate in our initiative
Availability of the relevant e-content	

Table 3: Deployment parameters for MeLTs

These 515 institutions that have been surveyed by the NIs include various levels as given in the figure 3. All these beneficiary institutions are supposed to be covered by the corresponding NI.

4. Deployment of MeLTs:

In order to deploy the MeLTs a need assessment survey was conducted in 515 schools and colleges in 22 districts of 6 states by 8 Network Institutions in their respective regions in greater detail and our group was responsible for conducting the survey in J&K where present authors (from SMVDU) were directly involved.

In Jammu & Kashmir a total of three districts bordering each other were covered for the pilot under NAS. The districts surveyed were: Jammu [covering 22 institutions], Udhampur [covering 17 institutions] and Reasi [covering 16 institutions]. The institutions that have been covered include 19 High Schools, 27 Higher Secondary Schools, seven Degree Colleges & two Polytechnics (Wanchoo *et al* LINC 2010).

Based on the results of the NAS, Van based VSAT enabled mobile e-learning terminals were fabricated and provided to the 10 identified network institutions by the coordinating institute (Table 4):

Coordinating Institute at National Level	**Network Institute**	**Type of MeLT deployed**	**State/ UT**
Indian Institute of Technology, Roorkee	NITTTR, Chandigarh	V-MeLT	Himachal Pradesh, Punjab, Chandigarh*, Haryana
	UIET, Chandigarh	V-MeLT	Punjab, Haryana
	SLIET, Longowal	V-MeLT	Punjab
	DBRA NIT, Jalandhar	V-MeLT	Punjab
	SMVDU, J&K	V-MeLT B-MeLT	Jammu and Kashmir
	HNBGU, Srinagar	V-MeLT	Uttarakhand
	BIAS, Bhimtal	V-MeLT	Uttarakhand
	MGCL, IIT Roorkee	V-MeLT B-MeLT	Uttarakhand Utter Pradesh
	RTU, Kota	V-MeLT	Rajasthan
	DDU, Nadiad	V-MeLT	Gujrat
	10 Network Institutions	12 MeLTs	8 States + 1 UT*

Table 4: Deployment chart of MeLTs

The deployment of MeLTs was done after several workshops, training programs to train the deployment staff. A short audio visual film on MeLT was also produced and distributed for the purpose of increasing the appeal of the concept and its advantages.

The MeLTs were deployed in select institutions in several regions covered under MeLT. In Jammu and Kashmir technology exposure was provided to the students of 15 schools and colleges in the three sample districts. As a part of this a deployment roster was prepared and V-MeLT was deployed for 8 hrs a month in each school for a select group of a minimum of 26 in institute to a maximum of 44 students in another one. Technology exposure was provided for 8 hours in a month spread over four days. There were four slots of 2 hours each for which the V-MeLT was stationed for a given class in a given institute. The exposure composed to instructional part and hands on part. Basic idea of this exposure was to expose the students, teachers and administrators of these institutions to the concept advantages and applications of MeLTs. The sessions composed of introduction to computers and various applications such as Ms Office, paint, internet explorer etc. All most all the students either did not have any prior knowledge or very primitive knowledge so far as ICT skills is concerned. Most of them did not even know how to switch on a Laptop. One teacher said that he did not have the opportunity to see or use computers as a student but is happy that his students would have access to them thanks to MeLTs. The technology exposure sessions were a treat to the students and they showed lot of enthusiasm in attending the same.

To evaluate the outcome of the technology exposure a third part post-test only experimental design method was used to undertake the impact assessment study.

5. Impact Assessment:

5.1 Objectives:

The objectives of impact assessment study were to determine the profile of the beneficiaries of the MeLT project. To study the nature of e-content utilized through VSAT Enabled Mobile E-learning Terminals and to study the reactions of students, teachers and administrators towards various modalities used in delivering e-content as listed below:

- Quality of e-contents delivered (relevance of content, quality of video, quality of audio, simplicity of language, adequacy of explanations, quality of illustrations, quality of text, rate of delivery, relevance of examples, integration of questions to stimulate thinking, usefulness of content etc.)

- Benefits (in terms of interaction among learners and with teacher. Learning, motivation, interest, access to education, supplement to teaching, additional knowledge and skills, independent learning, development of higher thinking skills, awareness regarding use of technology etc.)
- Problems faced (seating arrangement, supervision, screening, concentration of students, audio, viewing, distraction from environment, pace of delivery, etc.)
- Problems faced by project staff (number of students, non-cooperation by teachers, punctuality, students' basic knowledge, concentration, motivation, distance, basic amenities and facilities, etc.)
- Suggest strategies to improve the effectiveness and efficiency of the Van Based MeLT.

Thus a purposive sampling technique was used and was applied in the institutions falling in the jurisdiction of the following four network institutions (table 5):

Birla Institute of Applied Sciences, Bhimtal
HMD Garwhal University, Srinagar (Uttrakhand)
Rajasthan Technical University, Kota
Shri Mata Vaishno Devi, Katra (SMVDU)

Table 5: Deployment parameters for MeLTs

Technology exposure was provided by the four selected network institutions to the students of selected schools and colleges in their respective regions. From each school, 20-60 students, 3-5 teachers and Principal were included in sample for the study. In this paper we shall restrict the scope of our discussions to the five institutions/ schools falling under the jurisdiction of SMVDU, Katra.

5.2 Tools used for the impact assessment:

A set of four bilingual questionnaires, one each for Principal of the school/college, Teachers, students and Project Personnel were designed to elicit the necessary data and information. Data collection was done after providing the technology exposure to students of selected schools. Questionnaires were filled by the Principals, Students and Teachers based on the information pertained to the following:

General Information **(Principals)**
Number of Students **(Principals)**
Number of Students & Teachers **(Principals)**
Quality of e-content **(All)**
Benefits of e-content **(All)**
Problems faced **(Principals, Teachers, Students and Project Personnel)**
Attitude Towards Integration of Technology **(All)**

Table 6: Broad parameters of the questioners

5.3 Perceptions of Principals: Quality of e-content

The e-content was considered relevant and simple to understand by 80% of the principals. Sixty percent of the principals found the audio quality and the examples used in the content delivered as most relevant or relevant to the context. The quality of video of e-content was rated as good by 80% of the Principals. Seventy percent of the principals of schools found quality of illustrations (diagrams, figures, illustrations) as good. Majority of the Principals (86%) rated the quality of demonstrations as good.

5.4 Perceptions of Principals: Benefit of e-content

All the Principals agreed that e-contents used in VSAT mobile e-learning materials has created interest for the subject among students (100%); increased motivation for further study (100%); generated interaction among students (100%); supplemented classroom instruction (100%); created awareness regarding technology among students (100%); enhanced skills in use of computers (100%). All the Principals stated that there were no major problems related to seating arrangement, supervision, arrangement for screening, audio and viewing and pace of the delivery.

5.5 Perceptions of Teachers: Quality of e-content

Sixty four percent of the teachers covered under the survey perceived that the quality of e-content as relevant or most relevant and found the language of the e-content easy. One factor for this percentage to be slightly low can be that the e-content was not developed specifically as a part of this project and ready to use content from different sources was used. The development of e-content was not a mandate of this project.

Almost all the teachers opined that examples used in e-content were either most relevant or relevant. Quality of audio in e-content was rated as satisfactory by majority of the teachers. Both the quality of illustrations and demonstrations in e-content were rated to be good by majority of the teachers.

5.6 Perceptions of Teachers: Benefits of e-content

The plot (figure 1; table 7) show percentage of teachers who agreed, were indifferent or totally disagreed with the perceptions that were posed to them. It is clear from the plot that most of the teaches opined that e-content created interest for the subject among students, increased motivation to attend class and to opt for further study, provided examples for wide variety of settings, generated interaction among students and enhanced interaction with teachers, supplemented classroom instruction, provided additional knowledge, promoted independent learning, made learning easy, helped in clarification of doubts, provided exposure to number of experts, helped in developing reasoning ability, created awareness regarding technology among students, enhanced skills in use of computers and stimulated thinking. Majority of the teachers were of the opinion that e-contents were beneficial for them personally as well and created awareness regarding technology, suggested additional ways to use technology, motivated teachers for integration of technology in teaching-learning, enhanced use of technology in class-room, increased knowledge of subject matter, provided exposure to method of teaching, provided examples from wide variety of settings, helped in acquiring demonstration skills, helped in clarifying doubts and provided deeper insight in to the subject.

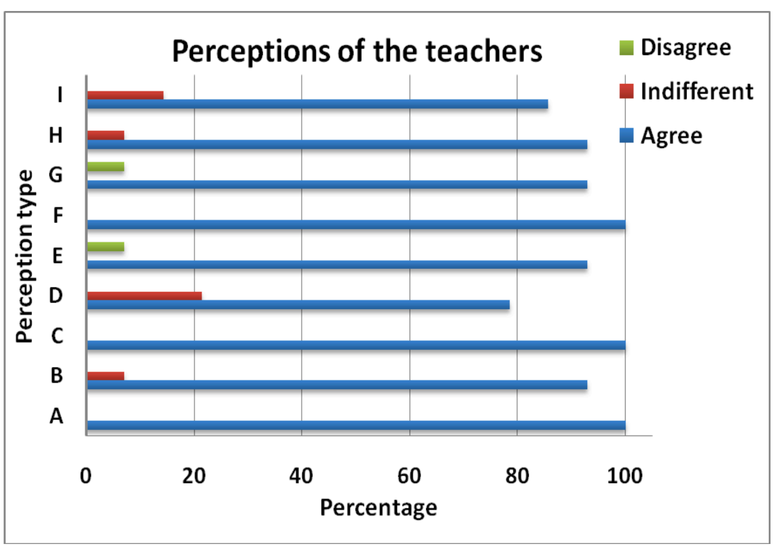

Fig 1: A plot of the percentage perceptions (table 7) of the teachers

Label (Y axis)	Particular perception of the teachers
A	e-content created interest for the subject among students
B	Increased motivation for further study
C	Generated interaction among students
D	Supplemented classroom instruction
E	Promoted independent learning
F	Made learning easy
G	Enhanced skills in use of computers
H	Created awareness regarding technology among teachers
I	Provided deeper insight into the subject

Table 7: Type of perceptions of the teachers that were included in the survey

5.7 Problems faced

Majority of the teachers did not report any major problems of, supervision, screening, and concentration, distraction from environment and pace of delivery during technology exposure to students. However, majority of teachers reported problem in supervision during technology exposure to students, problem in viewing of video films and some problems in audio which could be because of the fact that some of the schools did not have proper AV grade rooms and the sessions had to be conducted in the open. As a long term solution to this problem bus type V-MeLT was also developed and demonstrated. In this case the sessions were held inside the bus which is equipped with all such facilities.

5.8 Attitude towards Integration of Technology in Teaching-Learning

As a result of the technology exposure, it was observed (figure 2; table 8) that majority of teaches agreed that integration of technology in teaching and learning can lead to enhanced access to education. It is an excellent way to supplementing class-room teaching and leads to an increased interaction between teachers & students which acts as an enabler to make students more and more active. Integration allows students to learn at their own pace. Learning in multi-media environment leads to enhanced learning thereby arousing motivation to learn more than in normal class making learning an enjoyable affair than learning in normal classroom. Teachers also agreed that delivery with individual computer is beneficial than through shared terminals.

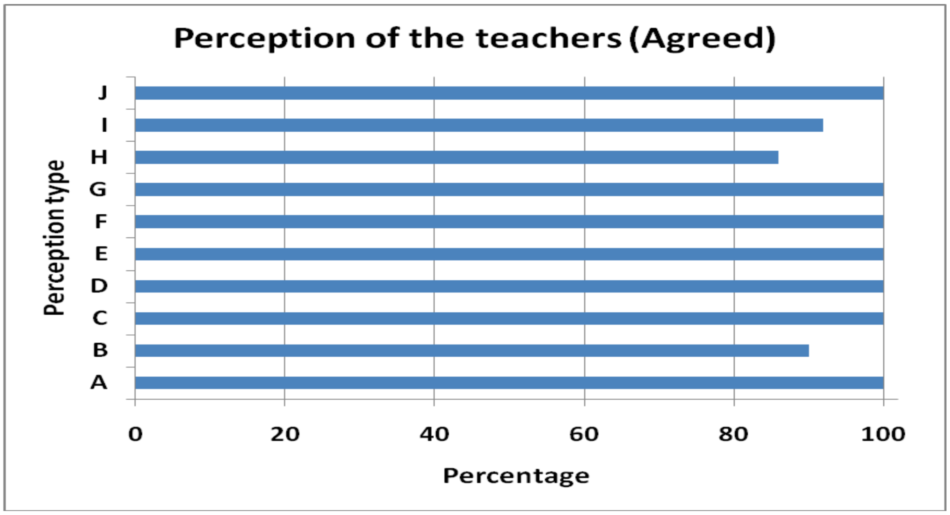

Fig 2: A plot of the percentage perceptions (table 8) of the teachers in agreement

Label (Y axis)	Particular perception of the teachers
A	Integration of technology in teaching and learning resulted in enhancing access to education (100%)
B	Supplementing class-room teaching (90%)
C	Increasing interaction between teachers & students (100%)
D	Increasing interaction among learners (100%)
E	Making students active (100%)
F	Allowing students to learn at their own pace (100%)
G	Enhancing learning in multi-media environment (100%)
H	Arousing motivation to learn more than in normal classroom (86%)
I	Enjoyable than learning in normal classroom (92%)
J	Delivery with individual computer beneficial (100%)

Table 8: Type of perceptions of the teachers

One can conclude (figure 3; table 9) that majority of the teachers expressed their disagreement that use of e-content is a waste of time and e-content delivery is just a tool for fun and nothing more of the students. Majority further disagreed that e-contents do not provide opportunities to students to clarify their doubts and that sitting and listening to e-contents is boring.

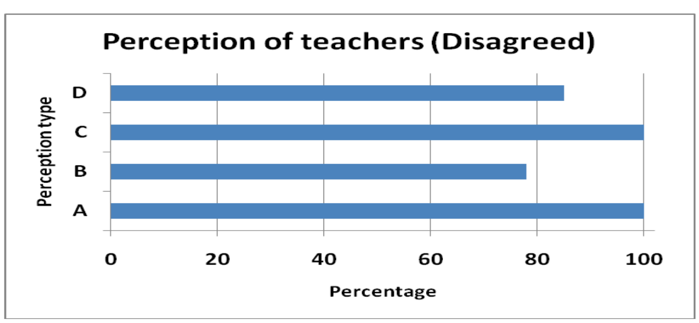

Fig 3: A plot of the percentage perceptions (table 9) in disagreement of the teachers

Label (Y axis)	Particular perception of the teachers
A	Use of e-content is a waste of time (100%)
B	e-content delivery is just a fun for students (78%)
C	e-contents do not provide opportunities to students to clarify their doubts (100%)
D	Sitting and listening to e-contents is boring (85%)

Table 9: Type of perceptions of the teachers

Both Principals and teachers of various schools opined that there were no facilities in classrooms for use of technology in teaching learning and teachers lacked skills in use of technology. Internet facility is not available in most of the schools in remote areas. A few schools have computer laboratory but its utilization is limited. Principals suggested that teachers should be trained in integrating technology in teaching learning and adequate facilities should be created in classrooms.

5.9 Perceptions of Students - Quality of e-content

As a part of this study it was observed that majority of the students found that the e-content which was delivered to them was either most relevant or relevant. Most of them found that the language of the e-content easy (a mixture of English and Hindi based e-content was used). Majority of the students found the use of examples in e-content as most relevant or relevant. They rated the quality of audio, video, illustrations and demonstration as good.

5.10 Benefits of e-content to students as described by students

Majority of the students (figure 4; table 10), who were provided technology exposure, were of the opinion that use of technology in teaching learning has been beneficial to them in creating interest for the subject among them. They feel motivated for further study after having gone through the exercise. It has lead to increased interaction among the students. They have been able to get extra inputs which they were unable to get in their normal classroom teaching resulting in excellent supplementing of the classroom teaching. The technology exposure has provided them with additional knowledge and has promoted a sense of independent learning among the learners. Since most of the students were exposed to e-learning technologies for the first one could observe that the awareness levels of the students were enhanced. Students observed that learning through technology is more enjoyable than traditional classroom learning. At the end of the technology exposure resulted in enhancing the computer skills of the students.

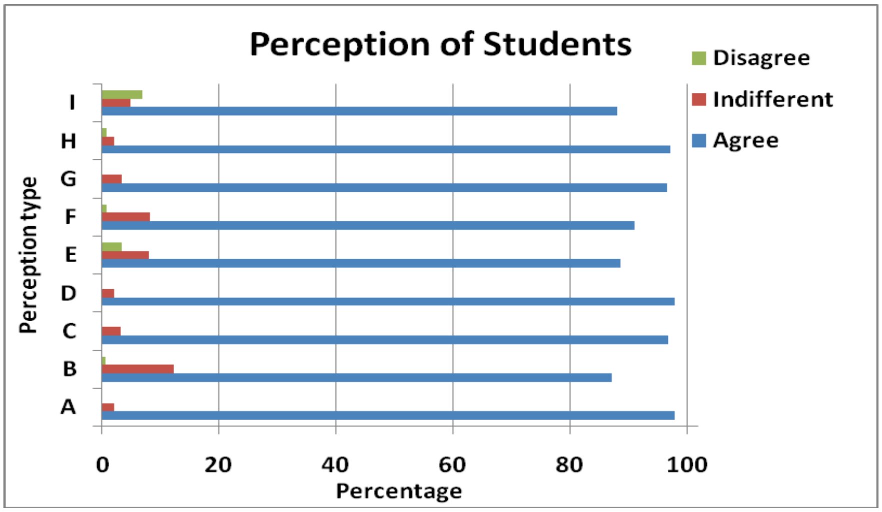

Fig 4: A plot of the percentage perceptions (table 10) of the students

Label (Y axis)	Particular perception of the teachers
A	Created interest for the subject among students
B	increased motivation for further study
C	generated interaction among students
D	supplemented classroom instruction
E	provided additional knowledge
F	promoted independent learning
G	created awareness regarding technology among students
H	enhanced skills in use of computers
I	learning through technology is more enjoyable than learning in classroom

Table 10: Type of perceptions of the students that were included in the survey

5.11 Problems faced

As most of the schools did not have proper rooms (AV grade) some of the students reported that there were some problems with respect to the seating arrangement, inadequate arrangement for screening which resulted in lack of concentration in a few cases, distractions from environment.

5.12 Attitude towards Integration of Technology in Teaching - Learning

Majority of the students agreed that use of technology in teaching-learning results in enhancing access to education not only for the normal students but is also helpful to students who are faced with some disabilities. It helps in supplementing classroom learning by the use of proper e-content which is helpful and provides that extra input which otherwise is missing due to non availability of access to technology in rural areas. Use of technology leads to a lot of queries among the students which, forces enhanced levels of interaction with the teachers and peers. It also allows them to learn at their own pace and enhanced learning due to multi-media environment (text, audio, visuals etc.) which is normally missing in chalk and board type of teaching prevalent in all such schools. As a result of this students reported that it has motivated them to learn and has made learning more enjoyable than learning in their traditional classroom. Access to individual computers is beneficial.

Majority of the students disagreed that use of e-content is a waste of time and e-content delivery is just a fun for students. E-contents do not provide opportunities to students to clarify their doubts and sitting and listening to e-content is boring.

6. Lessons Learnt

On the whole, the technology exposure provided to the students and teachers through V-MeLT has been appreciated and well received by Principals, students and teachers. As a matter of fact this happened to be the first intervention of its kind to have reached these schools as was opined by most of respondents. One of the significant remarks made by the Principals include the following "Students are getting lot of benefits of educational technology through MeLT project. This project needs to be continued. I strongly recommend this MeLT project to continue so that students may get most benefit of it".

On the basis of the findings and suggestions made by Principals, teachers and students, it is observed that identification of network institutions in various regions proved to be a one of the most critical reasons behind the successful implementation of the project and enhanced efficiency and effectiveness of the intervention. It was observed from the study that selection of e-content should be based upon the needs of the students and the context. The e-content should be preferably developed in regional or local language involving local teachers especially in case of school students to make it more effective. Another strong possibility that was observed from the study that the students and teachers suggested that the available e-content developed at the international level by various organizations should be dubbed in local language to make it easier for the students to understand for the students. It was also observed that there is a strong need for e-content covering variety of subjects and which would inculcate curiosity and creative thinking among the students rather than focusing alone on standard e-content being developed by most of the agencies. One important lesson that was learnt as a part of this exercise was that MeLTs sould be planned primarily for remote areas with inadequate educational facilities, disadvantaged or minority groups lacking educational facilities or time, physically challenged groups not in a position to take advantage of existing facilities and economically weaker sections of the society. The duration of intervention, technology exposure should be for a longer duration.

7. Acknowledgements

Authors would like to acknowledge the services provided by Prof. P K Tulsi and her team from Department of Education & Education Management, NITTTR, Chandigarh during the impact assessment survey.

How well does Sparse Blended Learning work? A Case Study from a Developing Country

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Abstract

Blended learning in a classroom setting serves multiple purposes of helping students and teachers learn from experts in a field. However, it is challenging to design sustainable implementations of such paradigms in developing countries. For example, most schools in developing countries do not have the technology infrastructure required to implement such approaches. This paper presents a unique method called 'sparse blended learning' that covers the complete curriculum, but in only a few blended learning experiences spread throughout the school year. In addition to blended learning, the approach also incorporates a live remote tutor, and online assessments. The technological infrastructure is brought to the students in the form of a self-contained 'learning van' that contains an electrical generator, servers, satellite connectivity to the Internet, a Wi-Fi network, and Android tablets. Content from Khan Academy was modified to use this approach for teaching Grade IV and V Mathematics in a remote semi-urban public mountain school in a developing country. The school caters mostly to the poorest children in the community. The results are that after over 6 months of intervention, there was a significant difference between control and treatment groups for both grades. Further, the effects are comparable to those expected from intelligent tutors.

1. Introduction

When it comes to deployment of learning technologies, developing countries offer unique challenges including lack of infrastructure and capital, trained teachers, educational governance, and high costs of Internet access [1]. For example, in 2011, there were 154,641 public, and 17,969 private primary schools in a developing country like Pakistan, with a total enrollment of 16,894,233 children and 436,928 teachers [2]. Many of these teachers are not trained to international standards. For example, 62.4% of public school primary teachers in Pakistan have a one year certificate of teaching (CT) and 49.6% only have a 12 year high school diploma [2]. Almost half the children of the 5-9 year age group are out of school in Pakistan [3]. While enrollment is a challenge, the quality of learning is also bleak. For example, only 27.9% of girls and 33.7% of boys of 5-9 year olds in rural areas can read. Similarly, only 25% of the girls and 32.5% of boys of this age can do simple subtraction [3]. Almost 56.6% of children in primary schools also end up repeating a grade [2]. From a governance perspective, the teacher attendance in government schools was only 83.1% which means that the teacher was 'officially' absent from the School 17% of the school year [3]. With a teacher to pupil ratio of 36.7, the class sizes are also relatively large in public primary schools [2]. Finally, in Pakistan only 38% of the primary schools have electricity [2].

One approach to problems of education in the developing world is to use a blended learning approach like the MIT Blossom's Project [4]. In this approach, videos of 'inspirational' teachers combined with associated teacher training materials are deployed in a classroom in a blended fashion. Videos are shown first, followed by problems to be posed and solved by students, and subsequent follow-up with additional videos is carried out. One important aspect of this approach is that it involves the teacher actively in addition to students. While this approach is promising in general, a number of issues arise when deploying such approaches in a developing country. First and foremost is the availability of infrastructure like a computer, and overhead projector and even electricity. While the numbers of Blossom's videos have grown over the years, another issue is the availability of videos to cover all the topics in a curriculum. The second issue can probably be resolved with time. However, the non-availability of technology infrastructure is a constraint that will remain for many decades to come.

This paper presents a learning approach called "sparse blended learning" for developing countries that actively incorporates the lack of infrastructure' constraint into account. In sparse blended learning, students are exposed to a blended learning scenario every few weeks rather than on a daily or a bi or tri-weekly basis as it would be in a developed country. In such a scenario, for example, material covered in the last two weeks of classes is covered on a single day using a blended learning approach similar to the MIT Blossoms program. This can be done by either taking the whole class of students to a computer laboratory, or by preferably bringing the technological infrastructure to them. In the research reported here, the later approach was followed where a 'learning van' was used to bring the technology infrastructure to a remote school every two weeks. The obvious question is how well such an approach works?

The rest of the paper is organized as follows. The chosen school is described next, followed by a detailed description of the sparse blended learning intervention. An evaluation of the effectiveness of such interventions is presented next. The paper ends with a conclusion.

2. The School

The school chosen for this study is situated near the town of Balakot in the Mansehra District in the Khyber-Pakhtunkhwa province of Pakistan. Balakot sits on the Balakot-Bagh Fault Line, and the school was completely demolished in the earth quake of October 2005, and was re-built using donor support. The school has a total of 11 teachers and a headmaster. Being a public school, the school caters mostly to the children of day laborers who represent the bottom economic tier of this semi-rural community. In most cases, the children are required to tend stock or engage in household work after school. Figure 1 shows a glimpse of the school environment and the children it serves.

Figure 1. The Public School chosen for this study

3. The Learning Intervention

The area targeted for the research reported here were Grade IV and Grade V Mathematics.

3.1 Content and Localization

Khan Academy (KA) [5] was chosen as the primary source of content for this intervention because it was thought that most Math content would be readily available. KA provides instructional videos tied to the *Mathematics Common Core Curriculum* of the United States [6]. KA uses traditional teach-and-test pedagogy where each topic is presented by a teacher in the form of a simple video using a blackboard. Topics are tied to multiple-choice online assessments organized according to topic maps. Students can take the assessment to test their mastery of the various topics. Tables I and Table II shows how the topics and Student Learning Objects (SLOs) from KA were mapped to the 2006 National Curriculum of Pakistan which is followed in the target school. Surprisingly, for various reasons like curriculum, cultural and pedagogical misalignment, only a small percentage of the KA videos (40% for Grade IV and 34.3% for Grade V) could be used, and 45 and 51 additional videos had to be created for Grade IV and Grade V Math respectively [7].

TABLE I. LOCALIZATION EFFORT FOR GRADE IV

Unit – 2006 National Curriculum	Sub-topics	SLO	Video/SLO	% KA Used
Numbers and Arithmetic operations	6	15	0.93	78.57
Factors and Multiples	6	13	0.77	70.00
Fractions	5	19	0.79	60.00
Decimals and Fractions	3	11	0.64	100.00
Measurements	4	17	1.12	0.00
Geometry	5	23	0.78	0.00
Information Handling	2	2	1.00	0.00
Total	31	100	0.85	40.00

TABLE II. LOCALIZATION EFFORT FOR GRADE V

Unit – 2006 National Curriculum	Sub-topics	SLOs	Video/SLO	% KA Used
Numbers and Arithmetic operations	4	11	1.00	54.55
HCF and LCM	2	5	1.20	16.67
Fractions	3	10	1.10	63.64
Decimals and Percentages	2	19	0.58	72.73
Distance, Time and Temperature	3	12	0.17	100.00
Unitary Method	2	6	0.67	0.00
Geometry	3	14	1.07	0.00
Perimeter and Area	1	6	0.67	0.00
Information Handling	2	7	0.71	0.00
Total	**22**	**90**	**0.77**	**34.78**

3.2 Technology Platform

Since a blended learning pedagogy was envisioned, a remote interactive classroom environment called *Teletaleem* (T2) coupled with the *Moodle* Learning Management System (LMS) to serve and archive the results of assessments was used. These assessments were delivered to the children using Android tablets via Wi-Fi. The original plan called for using the built-in adaptive formative assessment engine in KA. However, upon testing, the offline version of KA did not scale well to handle 30 Android tablets through the commonly available wireless routers. Consequently, Moodle was used as the assessment platform. Figure 2 shows a screenshot of the Teletaleem (T2) learning platform. The T2 platform allows a tutor to deliver remote presentations using a laptop and a standard camera and includes a whiteboard. The tutor is also able to view the video feeds of multiple classrooms in real time.

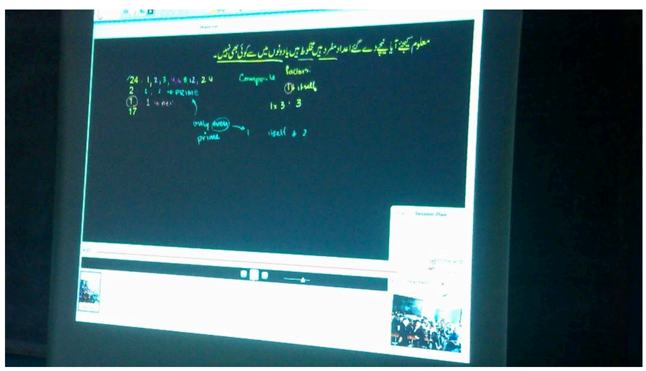

Figure 2. The Taletaleem Learning Platform

3.3 The Pedagogy

The learning intervention uses a blended learning pedagogy similar to the MIT Blossoms program [4]. However, unlike the Blossoms program, this pedagogical intervention also includes an experienced remote teacher who served as a role-model and a mentor for the in-class teacher. In addition, since the school targeted did not have computers or electricity, the learning videos were delivered through a "learning van" fashioned after the concept of a "traveling library." The learning van is a self-contained computer laboratory that contains a server, satellite access to the Internet, a power generator and UPS, wireless router, overhead projector, digital pad, teacher laptop, an external microphone and 30 Android based tablets that can connect to the server or the Internet wirelessly.

The learning van is designed to visit a school once every two weeks for a whole day and the pedagogy can be divided into three stages, pre-visit, during and post-visit. One week before the van arrives, based on the pace of each teacher, the local in-class teacher based in the school is asked to teach students a set of topics and SLOs before the van arrives. A customized online course including the SLOs and related assessments is created for each school for the day of the van visit.

Figure 3. . The learning van visit day activities

Figure 3 shows the sequence of events on the day of the visit. After the van arrives, children are shown a series of KA-type videos (Figure 3 (b)) on the topics discussed in the pre-visit phase with the in-class teacher. It is important to note that these sessions are conducted not by the in-class teacher, but by a remote tutor who is experienced and trained for Grade IV and Grade V Mathematics. This is partially done to provide mentorship for the local in-class teacher. After viewing a video on a specific SLO, the remote teacher uses the whiteboard to solve multiple sample problems to reinforce the understanding of students (Figure 3 (c)). In the next stage, the remote teacher invites students from the class to step up to the digital pad and solve additional problems. The tutor as well as the rest of the class can view how a child solves the problems (Figure 3(d)). After all the topics for day have been thus covered (about eight per day), the children are asked to check their understanding by attempting multiple-choice questions related to the topics they have just studied (Figure 3 (e)). Children use Android tablets to take formative and summative assessments. After taking assessments related to current topics, children are tested again on topics that were covered two weeks earlier to determine if any progress has been made. The results are recorded and made available through LMS reports. After attempting formative and summative assessments, the

In the post-visit phase, reports of children's assessments for the day is printed and discussed with the in-class teacher. In specific, the weaker students as well as SLOs where children did not perform well are identified. This report is then used to plan remedial session on topics for the next two weeks before the van arrives again. Finally, the results from last visit's assessments are compared with the current week to review any progress on remedial session for the last two weeks.

4. Methodology

This section describes the methodology used to evaluate the sparse blended learning intervention described in earlier sections.

4.1 Development of an Assessment instrument

Since there was no standardized instrument to measure the performance of children in Grade V and Grade IV Mathematics for the 2006 National Curriculum of Pakistan, a standardized test instrument based on Item Response Theory (IRT) [8] and classical analysis was developed. 400 items each for Grade IV and Grade V were constructed by experienced Pakistani item writers based on the 2006 National Curriculum of Pakistan. These 400 items were tested against the target population of students in Balakot and adjoining areas, and based on test results and subsequent statistical analyses, two standardized test instruments with 80 items each for Grade IV and Grade V Math were finalized.

4.2 Assignment of Control and Treatment Sections

The target school had two sections each of Grade IV and V. One section each of grade IV and grade V was randomly assigned to be either treatment or control. Table III shows the background of respective teachers for control and treatment sections. The control sections would continue with the normal teaching practices, while the treatment sections would be exposed to the learning intervention two terms. The intervention started on September 15, 2012 and was completed on March 8, 2013. At the end of the term, students in control and treatment group were tested based on the standardized test instrument developed earlier.

TABLE III. TEACHER QUALIFICATIONS IN CONTROL AND TREATMENT GROUPS

Class	Status	Teacher's Educational Qualifications	Teachers Years of Teaching Experience
IV	Treatment	12 year of schooling (HSSC), one year teaching diploma	19
	Control	12 year of schooling(HSSC), one year teaching diploma	22
V	Treatment	14 years of schooling (B.A.), one year of teaching diploma	20
	Control	16 years of schooling (M.Ed), one year of teaching diploma	15

5. Results

Results based on the final standardized test for both control and treatment groups are presented next. Since most grade distributions were found not be normally distributed (Anderson-Darlington test, p<0.05), non-parametric statistical analysis was used. Results of learning interventions are typically compared by reporting the effect generally given by equation (1) below by dividing the difference in estimated means by the standard deviation [9].

$$\text{Effect} = \frac{(\hat{\mu}_{treatment} - \hat{\mu}_{control})}{SD} \qquad (1)$$

However, it is difficult to compare directly the definition of 'effect' which is typically based on assumptions of normality when using non-parametric methods. Grissom and Kim [9] have proposed a method of calculating non-parametric effects by using the equation (2) given below.

$$\text{Effect} = \widehat{p}_{treatment,control} = \frac{U}{n_{treatment} n_{control}} \qquad (2)$$

Where n represents the sample sizes for treatment and control groups, and *U* is the Mann-Whitney *U* statistic. The effect described in equation (2) estimates the probability that a score randomly drawn from population of treatment groups will be greater than a score randomly drawn from population of control groups.

In order to compare the non-parametric results in an informal fashion, another definition of effect shown in Equation (3) will be used in this paper as well. This notion of effect is based on medians (as opposed to means) and provides an informal comparison to effects as defined using Equation 1.

$$\text{Effect} = \frac{(median_{treatment} - median_{control})}{SD_{pooled}} \qquad (3)$$

5.1 Grade IV Results

Treatment group ($n_{treatment}$ = 35; mean = 43.73; SD=13.06; median = 43.48) for grade IV performed significantly better than control group ($n_{control}$ = 37; mean = 23.15; SD=11.09; median =23.91) (Levene's test statistic = 0.22, P = 0.641; Kruskal-Wallis H = 32.01 DF = 1 P = 0.000; Mood Median Chi-Square = 29.49 DF = 1 P = 0.000; Mann-Whitney W = 1779.0 P<0.05). The overall effect was 0.8872 according to equation (2). This means that a randomly chosen student from the treatment group is likely to be better than a typical student from the control group 88.72% of the time. Based on 1-Sample Wilcoxon test, control group had an estimated median of 22.83 with a 95% confidence interval of [19.57, 27.16]. Treatment group, on the other hand, had a much higher estimated median of 43.48 with a 95% confidence interval of [39.13, 47.83]. The effect based on equation (3) was 1.61.

A breakdown of the results comparing results on the various learning outcomes covered in grade IV (only first 5 units were covered in the school year) are given in Table IV below.

TABLE IV. COMPARISON OF LEARNING OUTCOMES GRADE IV

Learning Unit 2006 National Curriculum	**% KA Used**	**Comparison with Control Group** * significant	**Estimated Median [95% Confidence Interval] Wilcoxon-Sign Test**	**Effect as per Eq. (2)**	**Approx. Effect as per Eq. (3)**
Numbers and Arithmetic operations	78.57	Levene's Test statistic = 1.30, P= 0.258; Kruskal-Wallis; H = 29.18 DF = 1 P = 0.000*	Treatment: 50.0 [40.9, 54.5] Control: 22.73 [18.18 27.27]	0.86641	1.21
Factors and Multiples	70.00	Levene's Test statistic = 0.00, P= 0.994; Kruskal-Wallis, H = 15.59 DF = 1 P = 0.000*	Treatment: 37.5 [31.3, 43.8] Control: 18.8 [12.5,25.0]	0.7861	0.7544
Fractions	60.00	Levene's Test statistic = 1.33, P = 0.253; Kruskal-Wallis, H = 20.44 DF = 1 P = 0.000*	Treatment: 40.0 [35.0, 45.0] Control: 20.00 [20.00, 25.00]	0.8265	1.354
Decimals and Fractions	100.00	Levene's Test statistic = 0.73, P= 0.395; Kruskal-Wallis, H = 22.38 DF = 1 P = 0.000*	Treatment: 43.8 [37.5, 56.3] Control: 18.8 [12.5,25.0]	0.8428	1.272
Measurements	0.00	Levene's Test statistic = 1.83, P= 0.181; Kruskal-Wallis, H = 13.00 DF = 1 P = 0.000*	Treatment: 44.4 [38.9, 50.0] Control: 27.8 [16.7, 33.3]	0.7642	1.134
Geometry	0.00	Not Covered	N/A	N/A	N/A
Information Handling	0.00	Not Covered	N/A	N/A	N/A

A multivariate correlation analysis based on Spearmen's ρ shows that the learning across units of learning was independent ($p < 0.05$). This means, for example, that children who did well in *Numbers and Arithmetic operations* did not necessarily perform similarly in other learning units and vice-versa.

As Table IV shows, even though there were differences, good effect sizes from 76.42% to 86.6% were achieved for the various learning outcomes showing a significant improvement over the control group.

5.2 Grade V Results

The treatment group ($n_{treatment}$=28; mean=55.24; SD=18.30; Median=57.45) for grade V outperformed the control group ($n_{control}$ = 28; mean = 43.84; SD=16.17; Median=42.55) (Levene's Test statistic = 0.28, P= 0.602; Kruskal-Wallis H = 7.69 DF = 1 P = 0.006; Mood Median Chi-Square = 4.57 DF = 1 P = 0.033; Man-Whitney W = 629.0 P=0.0058). The overall effect according to equation (2) was 0.2844. This means that the probability that a student in the treatment group would perform better than a control group student was 28.44%. The 1-Sample Wilcoxon method estimated the median of control group to be 43.6 and a 95% confidence interval of [37.2, 51.1]. Similarly, treatment group had a higher median of 57.4 and a 95% confidence interval of [50.0, 63.8]. There was an overall effect of 0.6162 based on equation (3).

TABLE V. COMPARISON OF LEARNING OUTCOMES GRADE V

Learning Unit 2006 National Curriculum	**% KA Used**	**Comparison with Control Group** * significant	**Estimated Median [95% Confidence Interval] 1-Sample Wilcoxon-Sign Test**	**Effect as per Eq. (2)**	**Approx. Effect as per Eq. (3)**
Numbers and Arithmetic operations	54.55	Test statistic = 0.26, p-value = 0.610; Kruskal-Wallis, H = 1.23 DF = 1 P = 0.268	Treatment: 57.1 [42.9, 64.3] Control: 50.0 [42.9, 57.1]	N/A	N/A
HCF and LCM	16.67	Levene's Test statistic = 4.58, P= 0.037; AD P<0.05. Cannot compare.	Treatment: 0.0 [0.0,50.0] Control: 0.0 [0.0, 0.0]	N/A	N/A
Fractions	63.64	Levene's Test statistic = 3.22, P = 0.078; Kruskal-Wallis, H = 4.13 DF = 1 P = 0.042*	Treatment: 28.6 [21.4,35.7] Control: 35.7 [28.6, 42.9]	0.6536	0.8467
Decimals and Percentages	72.73	Test statistic = 1.52, P = 0.223;Kruskal-Wallis, H = 1.86 DF = 1 P = 0.172	Treatment: 61.1 [50.0, 72.2] Control: 50.0 [44.4,61.1]	N/A	N/A
Distance, Time and Temperature	100.00	Levene's Test statistic = 0.19, P = 0.669;Kruskal-Wallis, H = 13.91 DF = 1 P = 0.000*	Treatment: 85.0 [60.0,90.0] Control: 45.0 [35.0, 55.0]	0.2142	0.63
Unitary Method	0.00	Levene's Test statistic = 1.20, P = 0.278; Kruskal-Wallis, H = 7.55 DF = 1 P = 0.006*	Treatment: 66.7 [58.3,75.0] Control: 41.7 [33.3, 58.3]	0.2920	0.442
Geometry	0.00	Levene's Test statistic = 0.00,P= 1.000;Kruskal-Wallis, H = 2.86 DF = 1 P = 0.091	Treatment: 42.9 [35.7,50.0] Control: 35.7 [28.6,42.9]	N/A	N/A
Perimeter and Area	0.00	Not covered	N/A	N/A	N/A
Information Handling	0.00	Not covered	N/A	N/A	N/A

Finally, a multivariate correlation analysis using Spearman's ρ shows that *Numbers and Arithmetic operations* was correlated with *Decimals and Percentages* (ρ= 0.817; Fisher's Z 95% confidence [0.410,0.953]) and *Unitary Method* (ρ= 0.804, Fisher's Z 95% confidence interval [0.378, 0.949]). Finally, *Decimal and Percentages* are correlated with *Distance, Time and Temperature* unit (ρ= 0.833, Fisher's Z 95% confidence interval [0.449, 0.957]).

So although there was an overall statistical difference between control and treatment groups in Grade V, the effects were much lower than for Grade IV. Considering that the study was conducted in the same school, it is difficult to ascertain why the effect was lower for Grade V. However, one hypothesis is that teacher qualification may have had an impact. As Table III shows, both teachers for grade IV had similar experience and training, while the teacher for the control group for grade V had an M.Ed as opposed to a simple B.A. for the treatment group teacher. This hypothesis, however, needs to be investigated further.

6. Conclusion

In are recent survey of tutoring systems, [10] argues that while it believed that answer-based, intelligent and human tutors have typical effects (given by equation (1)) of 0.3, 1.0 and 2.0 respectively, in reality, the effect is only 0.76 for intelligent tutors which is similar to human tutors where the effect is actually 0.79. If this is the case, then the sparse blended learning approach presented in this paper has performed quite well with effects (although based on medians and under assumption of normality) are overall a 1.61 for Grade IV and 0.6162 for Grade V Mathematics.

This paper explored a technology-enabled learning intervention using a 'learning van' to implement a sparse blended learning scenario in a remote mountain school of a developing country. The approach clearly worked in showing statistical gains in learning outcomes of the students. The next challenge is to scale this intervention to serve a larger number of students and teachers.

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The MIT LINC 2013 Conference

Parallel Presentations

Session #8

Creative Use of Social Media in Technology-Enabled Education

- "Collaborating Towards Learning, Using Social Spreadsheets for Health Education and Community Awareness" presented by Manu Sheel Gupta (India)
- "Using a Social Media Platform to Explore How Social Media Can Enhance Primary and Secondary Learning" presented by Sanjay Krishnan, Yuko Okubo and Kanji Uchino (U.S. & Japan)
- "Reflect and React: Social Media Used to Deepen the Discussion" presented by Martin Löfgren and Per Ahlkvist (Sweden)
- "Biochemians Got Talent: Student Assessment Through YouTube Video Presentations" presented by Jason Matthew (Republic of Trinidad and Tobago)
- "Innovate—Social Media and Open Source in Higher Education" presented by Enagandula Prasad and A. Ramakrishna Prasad (India)

Collaborating Towards Learning, Using Social Spreadsheets for Health Education and Community Awareness

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Abstract

Technology Enabled Education has provided the world with new and improved ways of learning. Various frameworks in different education sectors have been established in order to facilitate easy and effective communication and dissemination of information amongst the masses. In our effort to do the same, we have discussed the use of a Cloud enabled Social Spreadsheet to introduce a new system for development of an on-line Community Health Resource Centre. Through this paper, we aim to present a framework for information sharing and learning by demonstrating some use-cases, its user interface and instructional design.

1. Introduction

Past two decades have seen a phenomenal growth in understanding of health behaviors with a focus being largely on new community practices and ways to sensitize the masses about basic health and wellness [1]. With health literacy being indispensible in the present scenario [2] and a paradigm shift to create an international community for life-long knowledge distribution [3], the emphasis is now on creating web based applications that make health education available to all.

This is where Spreadsheets emerge as a valuable tool to collate data and present information while banking upon the organizational aspect of the framework. For organizations and institutes, the cloud based Spreadsheets provide with an interface that helps them collaborate with each other and contribute towards productivity and learning. There have been a number of spreadsheet tools that are available for users viz Google Docs, EditGrid, Zoho Sheet and Secure Sheet. Though we have all these spreadsheet tools available, the development of open source learning resources having its pedagogical advantages on the spreadsheet interface hasn't been fully realized.

SocialCalc provides a spreadsheet platform to create and share curriculum and content matter in a simple and an effective manner. It gives users an opportunity to form new information systems that help in communication by using spreadsheet as a tool to manage productivity and ease organization. Thus, it is imperative to develop practices and models that can help in improved learning and assimilation of health related knowledge.

This paper is a manifestation of such practices in our effort to introduce a novel approach of health information sharing in the world.

2. Introduction to SocialCalc Spreadsheet Activity on Sugar

Providing poor kids with affordable educational devices is the guiding principle of One Laptop Per Child (OLPC)[4]. The organization enables education for the kids in the developing world by providing them with low cost connected laptops (XO) with installed educational software. The software is designed to facilitate self empowered, critical and cognitive learning for all.

Sugar [5] is open source software used for this initiative. Sugar has introduced several activities to help students understand basic concepts in a playful manner. SocialCalc is the one of the well used spreadsheet activities of the Sugar environment. Its OLPC development was undertaken by Manu Sheel Gupta, Managing Director of SEETA with K.S Preeti and Vijit Singh, alumni from Netaji Subhas Institute of Technology and Luke Closs from Socialtext Inc. under the guidance of Walter Bender, Oversight Board Member at Sugar Labs and Dan Bricklin, Founder and President of Software Garden Inc. for Socialtext, Inc. [6].Through activities on Sugar, the aim is to :

- Make learning collaborative.
- Enhance cognitive understanding.
- Promote critical thinking.
- Emphasize upon usage of analysis and evaluation while learning basics of mathematics.

We are using one of the next generation versions of SocialCalc for Open Educational Resources (OER) called the EtherCalc.

3. Features of the Social Spreadsheet

The following are the features of the social spreadsheet:

3.1 Open and Inclusive learning - No user login is required. Every time you visit the site you can create one spreadsheet. You are provided with a unique URL.

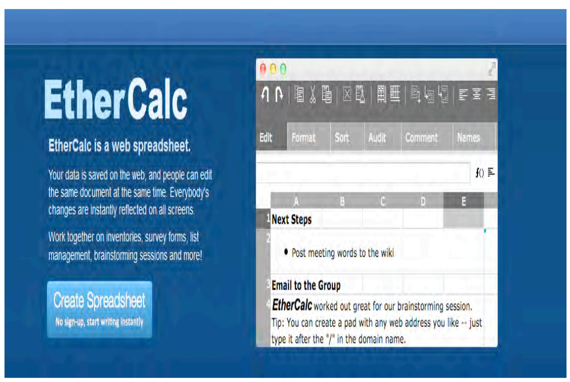

Figure 1: No login

3.2 Collaboration- EtherCalc employs an excellent feature of collaboration. As mentioned before, every sheet is provided with a unique URL and sharing that specific URL will allow others to view and edit contents in the sheet concurrently or turn by turn. Thus, collaboration is greatly achieved as the URL just needs to be broadcasted on any of the social media networks or otherwise in order to share the information.

Figure 2: Example of the Unique URL provided to every new collaborator

3.3 Customizable Web Address- The user may create a Spreadsheet of desired web address by editing and typing it after the “/” in the domain name.

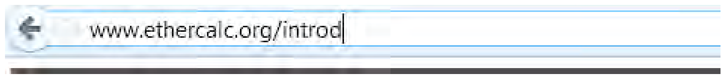

Figure 3: Editing the URL to a desired domain name

3.4 Editing the sheet: Clicking on URL of the existing sheet opens the sheet for any user to edit it.

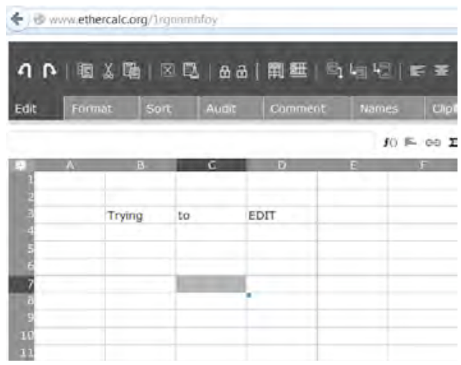

Figure 4: Edit Mode of the sheet

3.5 Cell Locking- To ensure that certain or all data in the sheet doesn’t get edited when opened by some other user, cells can be locked by the creator. This means that data in those (or all) cells cannot be edited by subsequent users. This shall ensure that useful information doesn’t get edited during the sharing process. All that a user is required to do is to select the cells for which the data shouldn’t be altered and click on LOCK option in the menu above.

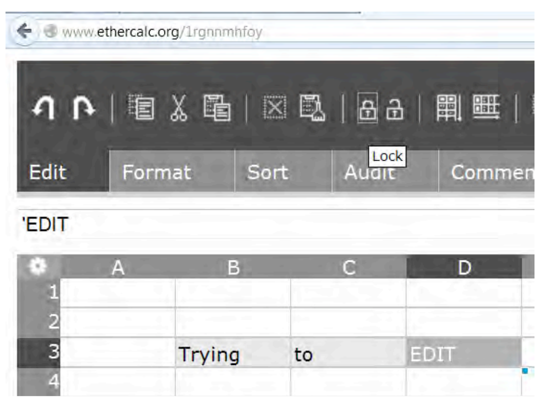

Figure 5: Locking the cells

RPC’s are created using the JSON (JavaScript Object Notation) [7]

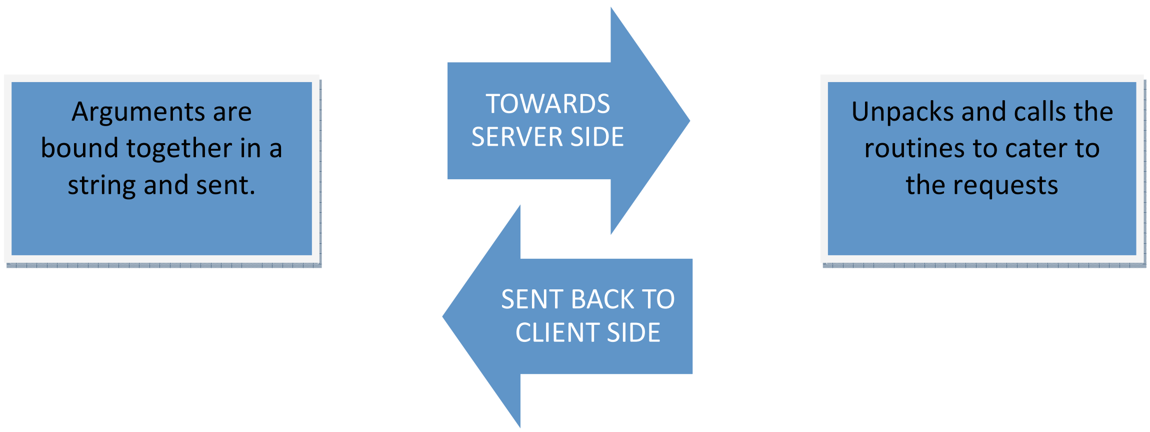

Figure 6: Making an RPC

Functions performed via RPC:

A user record for each sheet is maintained. Whenever anything is modified in the sheet, the changes are sent as string to the server side so as to reflect those changes and making them visible to other active users.

Synchronous checking is currently employed to reflect back changes from the server side back to the client. In this way, the client keeps on checking for any modifications by creating RPC after specific time. Thus, if any modifications are seen, the data is collected and shared back to the client.

4. Architecture for the Social Spreadsheet Framework

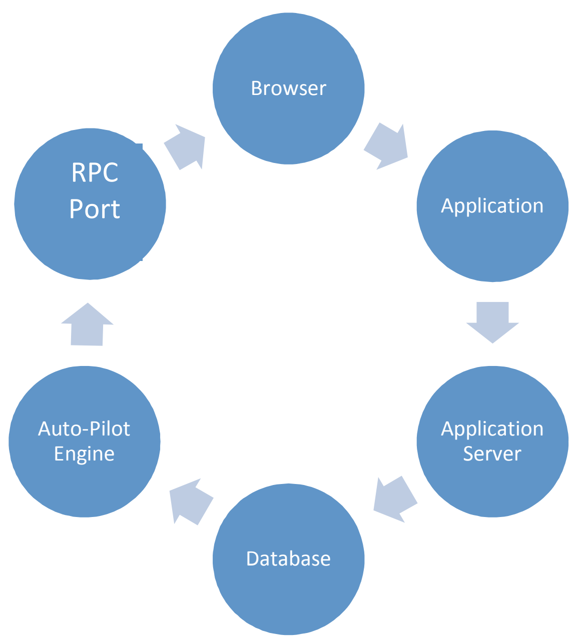

Figure 7: Software Architecture of the Social Spreadsheet

The above Figure shows the proposed architecture of the system. The framework can be used for other spreadsheet based activities.

5. Cloud enabled Social Spreadsheet

While focusing on taking the spreadsheet to the cloud, the architecture was designed to make it possible for the application to use the school server which is common for all the XO laptops. But in order to achieve the collaborative learning aspect, the Python and JavaScript language parts were modified, the framework was created and it was successfully setup on Google App Engine, where Python served the needs at the server side and JavaScript was employed at the browser. An improved version called “EtherCalc” has been contributed by Audrey Tang from Socialtext, Inc. using JavaScript at the server end and an improved speed of collaboration.

6. Building Community Health Resource Centre on Android phones

Frost and Sullivan have aptly mentioned healthcare as one of the major trends that would shape the future of the world [8]. The importance of nutrition in overall wellness of a human being cannot be understated [9]. Thus, sharing of relevant information in this domain amongst masses can be a great beginning to sensitize people and students about the health and wellness related issues. This can be of great help in creation of a health resource centre to mobilize information in the world about the basic facts associated with food, diseases, hygiene and human body as a whole.

Lesson Plan: Fundamental understanding of 15 Indian fruits and their varieties [10] for the students at the primary school level.
Principle- The underlying principle of creation of such a resource is to make the essential facts about nutritive value of fruits, their processing methods et al available at a cost effective open source mobile platform.
Features of the curriculum-

6.1. Creation of individual sheets for database- The idea here is to combine all the relevant data like the nutritive value of all fruits and to call it a unit.

- Here, Unit-1 summarizes and gives a comprehensive overview of nutritional aspects of various fruits available.

	Nutritive Value per 100 grams of fruit										
Fruits	Protein	Energy	Vitamin A	Carotene	Calcium	Iron	Phosphorous	Fibre	Vitamin C	Sodium	Potassium
Amla	0.5 g	58 KCal	151 I.U.	9 ug	50 mg	1.2 mg	20 mg	3.4 g	600 mg		
Apple		59 KCal		0 ug	10 mg	1 mg	14 mg	1g	1 mg	28 mg	75 mg
Ripe Banana		116 KCal			17 mg	0.9 mg	36 mg		7 mg		
Blue Grapes		58 KCal		3 ug	20 mg	0.5 mg	23 mg	2.8 g	1 mg		
Green Grapes		71 KCal		0 ug	20 mg	0.5 mg	30 mg	2.9 g	1 mg		
Guava (common variety)		51 KCal		0 ug	10 mg	1.4 mg	28 mg	5.2 g	212 mg		0 mg
Guava (Pahadi type)		38 KCal		0 ug	50 mg	1.2 mg	20 mg	4.8 g	15 mg		91 mg

Figure 8: Creation of unit-1 of the Health Resource Centre that contains the nutritive values of 15 Indian fruits and their varieties [10]

- Unit-2 on the other hand provides an entire module on a specific fruit cell. It gives facts about its history, names, nutritional aspect, activities for better understanding and provides the students with a questionnaire so that the teachers can easily assess how well the students have grasped the subject through these activities.
  Teachers may also add their comments or recommend changes in the Fruit Module so as to make this learning process collaborative and evolving.

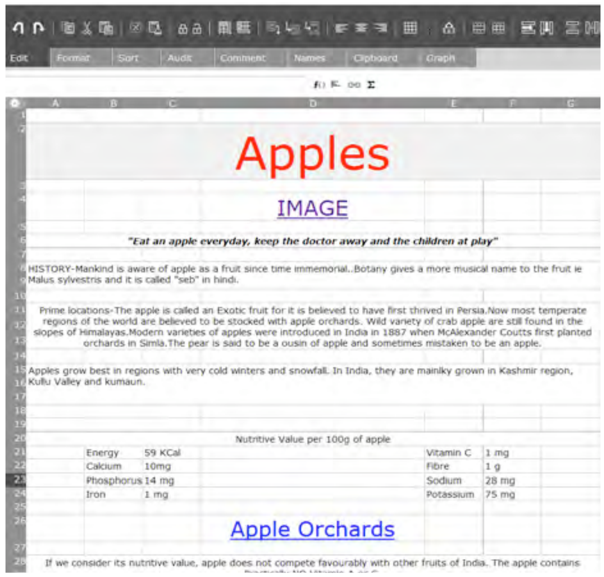

Figure 9: Fruit Module: Apple. [11]

Both, “Apple Orchards” and “Image” are hyperlinks that link to the external websites showing images of the fruit and orchards.

6.2 Creation of an index- As described before each unit has a separate URL. The biggest concern here is that the information, though collaborative, remains scattered. For this purpose, there is a need to create a combined index of various units and broadcast that index. Different units of information are assimilated into the index as a hyper link, clicking on which will take you to the separate sheet with the required information. This can be attributed to the ability of EtherCalc to link URLs in the sheet in a simple and efficient manner.

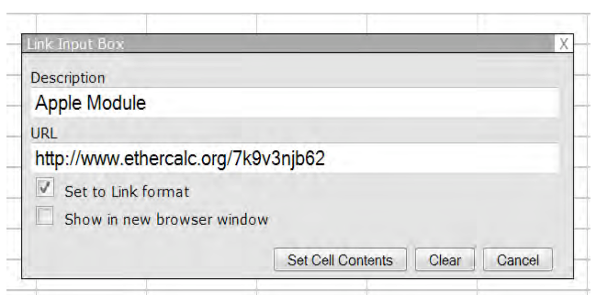

Figure 10: Creating a hyperlink from a URL to link modules

Thus, with this we aim to create a curriculum so as to provide students with a structured way of learning about health and nutrition. The curriculum aims at creating a learning mandate for students of a particular age group in a cost effective manner.

Fruits				Lesson Plan
Amla				Amla
Apple				Apple
Ripe Banana				Ripe Banana
Blue Grapes				Blue Grapes
Green Grapes				Green Grapes
Guava (common variety)				Guava Common
Guava (pahadi type)				Guava Pahadi
Jackfruit				Jackfruit
Jamun				Jamun
Roseapple				Roseapple
Ripe Mango				Ripe Mango
Green Mango				Green Mango
Musk Melon				Musk Melon
Water Melon				Water Melon
Tinda				Tinda

Figure 11: Creating index for Fruit Module where hyperlinks to different fruits represent their respective lesson plan.

Use Case 1: The creation of curriculum for any school in rural India with facility of just one desktop, mobile phones at home and lack of other learning resources.

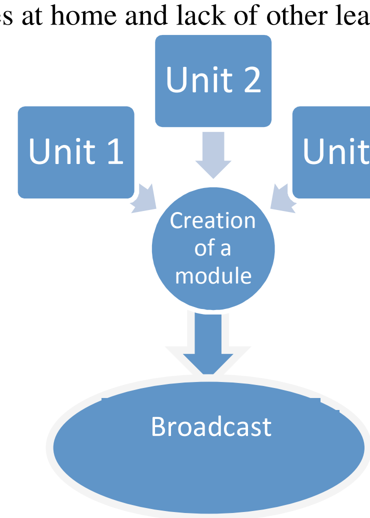

Figure 12: Creation of community health information module

The curriculum [12] will aim to provide the community members with a series of links to further the educational opportunities in the health sector. The fruit module may be executed as follows:

- Target group - Children in the age group of 8 to 12 years
- Resource required- Desktop or mobile phone at school and mobile phones at home. Internet connection is required.
- Assumptions – Frequent power cuts and lack of regular electricity supply.
- Objective:
  -To make students aware of basic facts about fruits, their types, locations etc.
  -To get a better understanding of fruits in their local regions and seasonality through various activities.
  -To make teachers assess the grasp of students by making them fill a basic questionnaire based on their observations.
- Pre Learning Activities: Make them observe a fruit, the seeds, color and so on by asking them to engage in group activities like cutting the apple and making it dry so as to retain the nutritional value of the fruit.
- Learning: Provide them with hard facts about these values, food processing techniques, locations, availability and so on as listed in the specific fruit module.
- Post Learning: Ask them to fill a questionnaire provided in the module so as to assess how well the students have grasped the knowledge.
- Collaborate: Share your knowledge with the community by adding your observations in the module, so modifications can be easily made.
  The modules can also be used to sensitize the adults in rural India during their evening classes, thus, realizing the dream of providing free and useful health educational resources to all.

Use case 2: Creating a system to disseminate information through mobile phones about deficiency diseases in rural India.
Principle- The aim is to create useful material that could help children and adults to understand malnutrition; its causes, symptoms, type, prevention and cure.
Operations: The following use case is also developed by using the aforementioned model. This is done by creating units and linking them to the main Disease Module that contains hyperlinks to the other deficiency disease units.

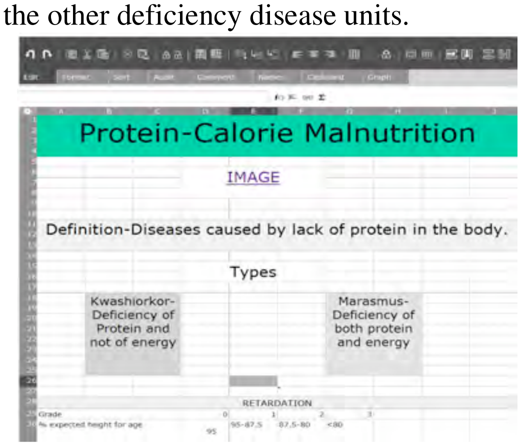

Figure 13: Protein-calorie malnutrition details

7. Implementation Plan

The milestone and tentative timelines for deployment of the Community Health Center are discussed in the following table.

Milestone	Tentative Timelines
Deliverable I – Prioritized list of learning objectives	T+2 Weeks
Deliverable II – Lesson Plans	T+5 Weeks
Deliverable III – Teacher Training Workshops	T+7 Weeks
Deliverable IV – Deployment and Support	T+10 Weeks
Deliverable V – Assessment	Mid-term and Final project

Additional support requirements:
The deployment team will ensure that sufficient capacity of teachers is developed during the teacher training workshops. However if the school or community centre would like any hand holding support from the deployment team, the same will be organized via conferences and webinars.

8. Monitoring and Reach

With the introduction of this new form of knowledge sharing for health and wellness, it becomes pertinent to monitor the quality of reach and understand user behavior and needs. For the same, we plan to integrate a Customer Feedback Form [13], planned to be evolved and made available at the home page of EtherCalc as a hyperlink. Thereby, the analytics provided by user feedback will help us evaluate and create a seamless platform to promote health education and awareness.

9. Future Scope

While the main focus in this paper remains on sharing of health and wellness related information to all on the cloud, we aim at creating a robust chassis for establishment of such a knowledge sharing platform in every branch of education so as to standardize learning and create resources for the emerging world.

10. Acknowledgements

We wish to thank Walter Bender and Dan Bricklin for giving us the opportunity to work in SocialCalc project under their valuable guidance. We wish to thank Audrey Tang, Preeti K.S., Luke Closs, friends from Socialtext Inc. and Digital Literacy Project, Suryanarayan Ramamurthy, Vijit Singh, Nick Doiron, Yatharth Bansal, Sushant Bhatia, Rohan Anand, Aoopam Aggarwal, Kshitij Tulsyan Mehak Aggarwal, Mithil Gupta, Ayush Goyal, Rohit Jain, Mahesh Chand Sharma, Shubham Shukla, Sakshi Chawla, Diksha Khatri and Lakky Rawat for contributing in the development and deployment of the SocialCalc spreadsheet platform.

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Using a Social Media Platform to Explore How Social Media Can Enhance Primary and Secondary Learning

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ABSTRACT

The growing set of Social Media tools such as Twitter, Facebook, Instagram, and Google Docs has the potential to enhance primary and secondary learning. To collect and evaluate suggestions for novel applications of social media to learning from online participants, we created a version of our Collective Discovery Engine. Over 155, educators, engineers, and social scientists responded to our emailed invitations to participate. In this paper we summarize the experiment, the data collected, and the responses. Suggestions were broadly classified into three categories: collaboration, diversity, and evaluation. We report on demographic correlations and present the suggestions that participants collectively considered most valuable (effective and/or novel). The interface is available online at:
http://opinion.berkeley.edu/learning

1. Introduction

The Collective Discovery Engine (CDE) is an interactive visual and social environment designed to allow participants to collaboratively generate, and evaluate ideas around topics of interest. CDE was developed as a part of the Opinion Space project [11] at University of California Berkeley, and has been applied to many different discussion topics.

Figure 1: The Collective Discovery Engine interface where each participant and textual responses is represented by a circular "bloom" on the left. The position of each bloom is determined by dimensionality reduction of an 8-dimensional continuous space, and the size of each bloom is based on the reputation of the textual comment as determined by other participants.

On July 15, 2012, we launched a project to brainstorm ideas on how Social Media could be used to enhance primary and secondary learning. Our primary goal was to connect a diverse group of educators, engineers, and social scientists. The project ended December 15, 2012. We analyzed the textual responses collected, a profile of the participants, and how participants evaluated the response of others.

2. Related work

In 2012, MMS conducted a study on Social Media and K-12 educators [49]. About 82% of K-12 educators are members of social networks, which show a growth of 34% from the previous survey in 2009. The study also listed two concerns of educators: privacy (84%) and information overload (65%). These quantitative results complement our qualitative results from participants, and also re-iterate CDE's critique of the data deluge in Social Media.

Self-organizing collective systems, like CDE, have also been explored in the context of education. In a 2002 education journal, Wiley and Edwards described the future of distance learning as one with Online Self-Organizing Social Systems [44]. In 2005, Squire [41] argued that collaborative games are a powerful part of learning and knowledge creation, and notes the interesting self-organizing behavior of these games. Our work takes advantage of both the phenomenon described in these publications and combines self-organizing social learning with aspects of gameplay. Recently, research has looked into interfaces for MOOCs (Massive Open Online Courses), such as Coursera and edX. Daniel [9] argues that researchers have not settled on an interface paradigm for these systems. Using ideas from Machine Learning and Information Retrieval is an active area of research [48].

Lave and Wenger argue that learning is not merely a knowledge transmission, but a social process where individuals participate in a "community of practice" where the knowledge is collectively constructed [21]. In addition, Sugata Mitra, the winner of TED Prize at TED2013, proposes the notion of learning as "self-organizing organism" where people learn in self-driven learning environments in their own lives. This resonates "peer-based self-directed learning online" reported by Ito et al. [28].

Woolley et al. describe "collective intelligence systems" like the CDE. They argue that diverse groups can address tasks better than any individual member [45]. Political scientists have long praised public opinion polling as "inclusive" democracy. Berinsky [4] argues that polling is one of the most inclusive means for participating in political discussions. An alternate form of public opinion polls first proposed by Fishkin in 1991 [12], deliberative polling, is where participants are first polled on a set of issues, allowed to deliberate for a period of time, and then polled once more. Online deliberation has since been extensively studied [8].

CDE also draws from many recent research and commercial projects such as All Our Ideas [39], Debategraph [3], Sidelines [29], BALANCE [30], SpigIt, IdeaScale, Innocentive, and BrightIdea.

Visualization in Social Media has been extensively researched [6][34], and many different projects have addressed scalable interactive visualization. Freeman [13] surveys the work in social network visualization. Viegas and Donath [42] explore visualizations based on emails: graph-based visualization and visualization of temporal patterns. They argue that visualization should go past the standard graph-based approach. Morningside Analytics visualizes online communities through textual and content analysis. Sack presents the Conversation Map interface that has a graphical display of links between message content [38]. Other visualization interfaces include SocialAction, which, like CDE, allows for the visualization of social network based on similarity measures [29]. Vizster is also a system for visual search and structure analysis [16]. We The Data (http://wethedata.org/) visualizes the network structure of topics and questions. One focus of the Stanford SNAP project (snap.stanford.edu) is visualization. In addition it has publicly posted social network datasets which have led to a series of analysis and visualization projects.

As a part of our projects, we have explored the role of incentives and scores in encouraging participation. Addressing incentives for information sharing is an active field of research [36][37]. In addition, the problem of assigning scores has had interest. Altman and Tennenholtz [1][2] lay the axiomatic foundation for analyzing ranking systems. Such systems have been evaluated for resistance against manipulation [14][47], and have even been framed as dimensionality reduction problems [20]. Furthermore, work in collaborative filtering has addressed the problem of preferential attachment, or a rich-get-richer effect, seen in many recommender systems [15][46].

The CDE asks participants to express their opinions using both the Visual Analog Scale and textual input boxes. Continuous scales have been applied in many applications [27][43]. In fact, some of the original work in dimensionality reduction was in psychometrics [19].

We also draw heavily from the field of collaborative filtering, opinion mining and recommender systems. Pang and Lee [31] extensively surveyed the field of Opinion Mining, and extracting data from Social Media systems. Like CDE, many of these systems rely on low-rank approximations and dimensionality reduction [35]. Our project also tries to highlight diversity which is a popular research topic in recommender systems [32][26].

3. System description

CDE is a social media tool with novel visual interface that allows participants to interact with textual responses on an interactive graphical map. CDE combines ideas from deliberative polling, dimensionality reduction, and collaborative filtering, to highlight particularly insightful ideas. In an initial controlled (laboratory) user study comparing this interface with list-based interfaces, participants read a similar diversity of responses. Participants were significantly more engaged and they had significantly higher agreement with and respect for the responses they read [7][8].

CDE instances are focused on a specific discussion question. In this project the main question was:

"**How can Social Media be used to benefit primary and secondary learning?**"

To position their point, participants entering the space first express their opinion on the following profile questions using Visual Analog Scales [27] (from strongly disagree to strongly agree):

1. Google Docs can help students learn math by enabling them to work together to solve problems.

2. Social Media games like "Words with Friends" can teach students about collective problem solving.

3. Twitter can expose students to new perspectives on topics they are studying.

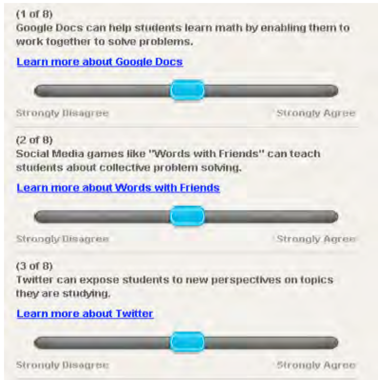
4. Facebook can improve student's social skills.

5. A degree from an on-line school like Khan Academy is equivalent to a high-school diploma.

6. Nothing can replace a pencil and paper for learning.

7. Facebook causes distraction for primary and secondary students.

8. Video lectures are better than traditional lectures as they free up class time for group discussions.



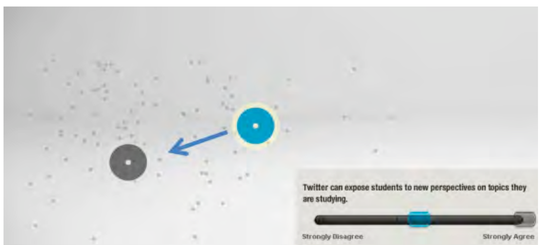


Figure 2: Participants enter responses on a visual analog scale. Their responses are visualized with a 2D projection as they move the scale.

The numerical responses to these questions define a vector in a multi-dimensional space. We apply Principal Component Analysis (PCA) [33] to project the vector onto a two-dimensional plane for visualization and navigation. This places all participants onto one level playing field. Points far apart correspond to participants with very different opinions, and participants with similar opinions are proximal. The arrangement of points is statistically optimized to convey the underlying distribution of opinions and does not correspond to conventional left/liberal and right/conservative polarities.

After placing their point, participants contribute a textual response to the primary discussion question. Participants can view and rate responses of others by clicking on the associated points in the visualization. When a point is selected, a window displays the response entered by the corresponding participant with two prompts, each accompanied by additional sliders (visual analog scales):

1. **"How effective will this idea be?"**
2. **"How innovative is this idea?"**

Participants are assigned an Author and Reviewer scores based on how others evaluate their response and how they evaluate the responses of others.

4. Results

The project launched on July 15th, 2012 and ran until December 15th, 2012. In the course of these five months, 552 unique visitors arrived, of these 155 registered and completed the profile questions. The system collected 118 suggestions from those 155 participants. The 118 textual responses collectively received 751 ratings of efficacy and 783 ratings on innovativeness. The system attracted participants from many different age groups and locations. 67% of the participants self-reported their location as the United States, with China (8%) and Japan (7%) as the next largest sources.

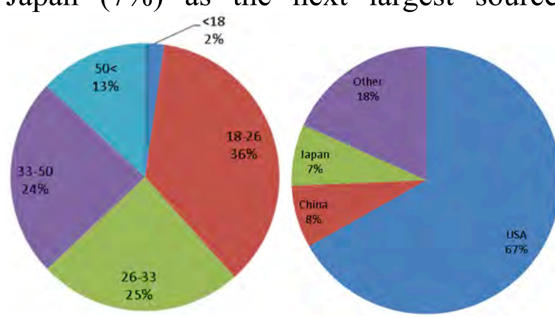


Figure 3: Participants were asked to self-report their age and current location. Most of the participants were 18-26 and from the United States.

4.1. Analysis of participant profile data (quantitative data)

From the profile question responses, we found that most participants agreed that Facebook was a distraction for students and were skeptical about equating the Khan Academy with a high-school diploma. The most contentious question was whether a "Pencil and Paper" education could not be replaced. Surprisingly, the question about Twitter was more positively received than the questions about Facebook.

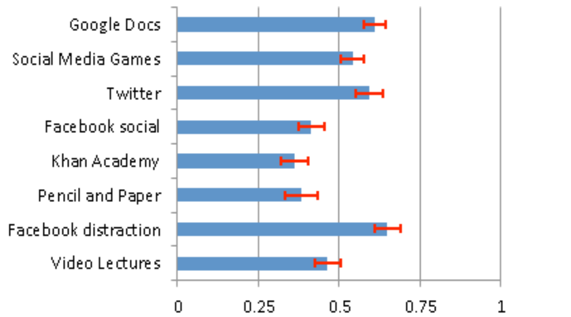


Figure 4: For each profile question, we calculated the average response and the standard deviation in responses. Most felt that Facebook was a distraction to students and the most disagreement was on the question about Pencil and Paper education.

We also considered the role that age played in the way that participants responded to the profile questions. We also found that age groups roughly agreed on most of the questions. After running a statistical significance test, we find that two only sets of responses have a statistically significant correlation with age (Video Lectures, and Pencil and Paper). Older participants valued video lectures more than younger ones did, and were also more likely to accept alternatives to "pencil and paper" learning.

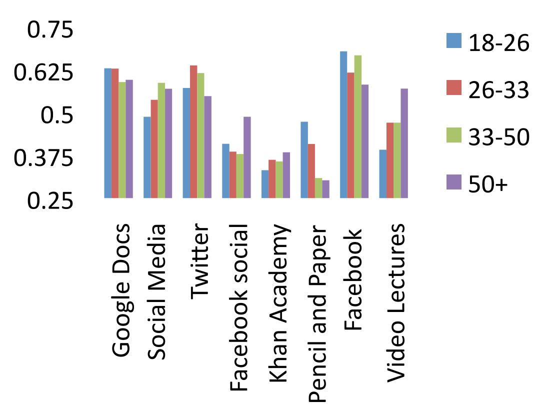


Figure 5: Mean ratings conditioned on age. We found that age groups roughly agreed on most questions, except for the questions about "pencil and paper education" and "video lectures".

4.2. Ranking textual responses

We ranked the textual responses based on the two categories: innovation and effective. We found that these two axes were strongly positively correlated. In addition, on the whole ideas were rated very positively. That said, this audience did have disagreements over ratings, and the mean standard deviations of effective ratings was .2056.

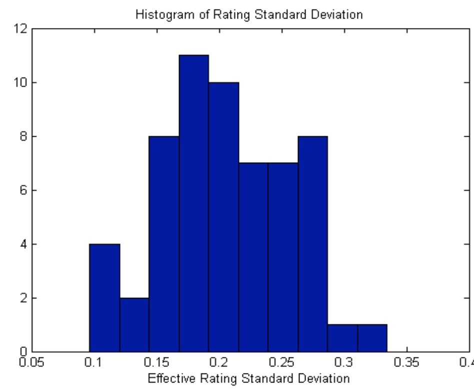


Figure 6: For each textual response's effective ratings we found that there was a relatively high disagreement among raters with an average standard deviation of .23.

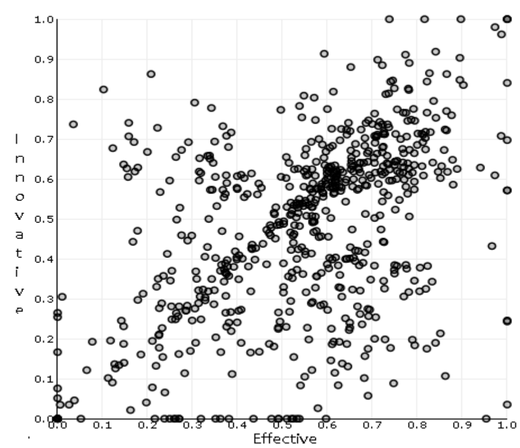


Figure 7: A scatter plot of effective and innovative rating pairs. We find that the two ratings are strongly positively correlated with many ratings falling on the diagonal.

4.3. Classification of textual responses

From the top rated responses, we find that three broad topics resonated with our participants: diversity, collaboration, and evaluation. We went through all 118 of the textual responses, manually segregating them into one of the broad categories, or other if it was sufficiently different. Surprisingly, nearly 68% of the suggestions could be interpreted as describing one of these common themes.

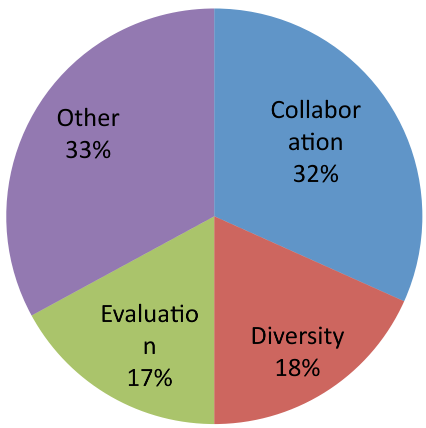


Figure 8: Manual categorization of textual response into a topic. Using social media for collaboration was the most popular topic.

Furthermore, we found that topic of "collaboration" was strongly correlated with age.

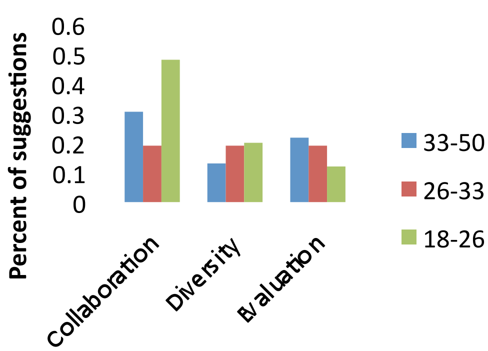


Figure 9: Correlation between age and topic choice. Younger participants were more likely to discuss collaboration, collaboration software, and the benefits of student collaborating.

Many more of the younger participants suggested Social Media a collaboration tool compared to other age groups. Diversity and Evaluation did not have statistically significant relationships with age. Unexpectedly, geographic location was uncorrelated with all of these three topics.

4.4. Profile qustions correlations

Responses to the eight initial profile questions were correlated, and we found interesting correlation relationships between the questions. The CDE visualization illustrates these relationships when a participant responds to a profile question, and the visualization moves their point along a PCA axis.

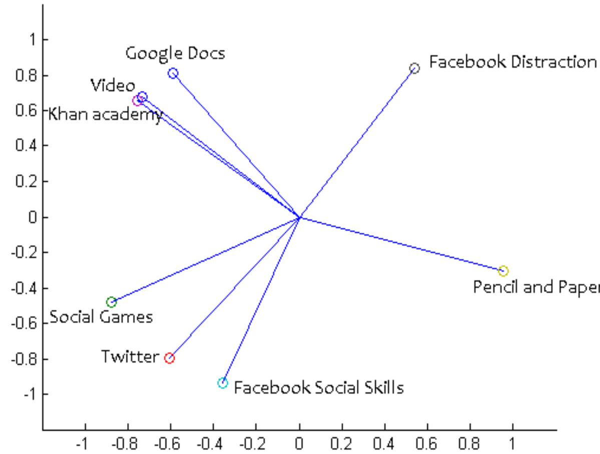


Figure 10: When participants move their sliders to respond to the profile questions, their point moves. The directions in which their point moves for each question is related to the correlation between the questions.

These angles are related to correlations between responses to the questions. The mathematical explanation for this relates to the PCA algorithm. The PCA algorithm tries to find axes that best explain differences between user's responses (i.e. if all excluded). These axes are not necessarily responses to a single question, and are in general linear combinations of the question responses.

When we look at this property in two dimensions (only two axes), questions that are strongly correlated account for the same differences and thus are weighted in a way so that they contribute to same axes. As a result, responding to correlated questions result in "movement" in similar directions. This idea is related to the mathematical concept of Principal Angle (or Canonical Angle), which is the minimum angle between two subspaces.

5. Insights from the textual responses

Combining our analysis of the top responses, profile questions, and demographics, we found the following insights about Social Media and Education:

1. Students can use collaboration software, such as Google Docs and Wikis, for team projects. In addition to facilitating teamwork, these allow teachers to track who has contributed to the project and in what ways.
2. Social networks can help teachers to share materials and ideas. An example would be a Wiki-style platform for teachers to develop curriculums and best practices and share it with others. Similarly, there is a need for a "trusted" network for students, where information from this network is academically acceptable. This conclusion is supported by MMS Education's 2012 study which reports Webinars (48%), document sharing (34%), Wikis (25%) and social networks (20%) as the top four tools among educators [49].
3. Foreign language education can take advantage of an international pen-pal system.
4. Online tools can give a teacher more ways a teacher to measure a student's progress. These tools can also lead to adaptive lessons, and customization of lesson plans.
5. Social media can promote community service and civic involvement, and it can be a conversation starter about current events.
6. Facebook is not a preferred platform for education, and many participants were skeptical about its impact on students. Twitter on the other hand was seen much more positively both in the profile question response and textual responses.
7. Math and Art-practice can benefit from tools such as collaborative equation editors and multi-media message boards.
8. Social media can expose students to other cultures. Students can collaborate with others in different parts of the country.
9. Games, points, or social credits can be part of the evaluation process.
10. Presenting and sharing can go beyond the classroom, where students can share their work with on the internet. Students can learn by watching other students in different places.

6. Conclusion

We discovered interesting quantitative results such as a perception that Facebook is a distraction for students, that older participants value video lectures, and some skepticism about current online-learning platforms like the Khan Academic. In the textual responses, we found that three broad topics of interest: collaboration, diversity, and evaluation. We discovered that younger participants were more likely to discuss the use of collaboration software such as Wikis, Google Docs, and educational tools like Piazza.

With increasing learning opportunities available through online resources, a new way of conceptualizing learning changes our notion of education to a "process guiding youths' participation in public life" as well [28]. The findings of our experiment also suggest effective alternative teaching processes. Through the use of Social Media, teachers and adults can offer students support in order to prepare them for broader public life.

7. Future work

In future work, we will refine the user interface to make the system easier to use based on user study and data collected from this project. We are also designing an analytics platform to track participation as it involves. In addition, we are exploring the use of spectral methods for large-scale text analysis. This work also includes integrating CDE with the distributed Berkeley Data Analytics Stack. We are also exploring internationalized versions of the software to address discussions in different languages.

This research was funded in part by Fujitsu and the UC Berkeley Data and Democracy Initiative. We thank Siamak Faridani for his help on many aspects of this project.

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Reflect and React - Social Media Used to Deepen the Discussion

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Abstract

This paper describes a formative dialogue method using social media. Our project was at first meant to be used to develop and deepen the classroom discussion concerning subjects as xenophobia, human rights and equality, but we soon realized that this dialogue based forum was an extraordinary arena for practising language and central skills pointed out in the Swedish curriculum. In giving the pupils instant feedback during the process, and, thus, instant possibilities to practise and develop their language skills, it is clearly a formative way of working. The teacher or a pupil decides on a topic for discussion, the pupils write in the forum and the teacher and other pupils give feedback and advice on how to evolve the text. We found that this method was very rewarding for the pupils since they could now use their new found knowledge instantly, instead of having to wait, as is often the case in school.

There are great possibilities when it comes to language learning and developing the skills pointed out in the curriculum, such as evaluating the sources, looking at questions from different points of view, using central concepts, reading analytically and writing coherently.

This form of dialogue is also optimal for exchanges with universities and their aspiring teacher students. What better way to prepare to become a teacher than to interact with pupils in authentic situations?

Keywords : *Formative method, instant feedback, dialogue, self- and peer appraisal, source evaluation, social media, language development*

1. How it all began

After having studied and talked about different aspects of human rights, we organized a classroom discussion where the pupils were meant to use their new found knowledge to compare the possibilities different people have in society concerning things as gender, age, wealth and to understand what it is like for people from other cultures to be integrated into a new society.

Topics of this kind, related to human rights and democracy, are not only important in social studies, but they are also a vital part of the Swedish curriculum. Every teacher is obliged to work with the common values stated in the curriculum, no matter which subject you teach. In the Curriculum for the Compulsory School System, it also says that:

"The school should be open to different ideas and encourage their expression. It should emphasise the importance of forming personal standpoints and provide opportunities for doing this." .[1]

The discussion took an ugly turn when one of the pupils expressed xenophobic views and offended a classmate with another cultural background. The discussion now turned into a debate with locked positions, primarily based on prejudice and emotions. A typical classroom debate has many flaws: it is unequal since there are hierarchies within the group and between the pupil and the teacher. That causes many pupils to remain silent instead of expressing their opinions. It does not give the participants any time to reflect on their views, since it is constrained to a given time and place and often based on emotions rather than facts. We were frustrated and felt the need to find an arena where these discussions could take place. We needed a forum where we had time to reflect, and where every pupil had the same possibility of giving his or her opinion. We wanted facts rather than emotions to provide the basis for the arguments.

Our ICT-advisor presented the idea to move the discussions from the classroom to social media. Together we found the networking tool Ning, which provided us with the necessary components for our discussions. It gives the possibility of inviting those concerned, it lets the pupils create their own pages and it simplifies the use of other media in form of links that the pupils can add or follow.

2. The working process

Each discussion begins with a new topic, suggested by a teacher or a pupil. The topics are always introduced in the classroom to make sure that everyone understands what we are going to discuss and why. Before we begin, we also talk about which skills the pupils are meant to practice and develop. Such skills could for example be to see a topic from many different perspectives, the skill to argue for something, the skill to analyze what other people has written and to evaluate sources. These are all skills pointed out as objectives in the Swedish curriculum. By using an assessment grid, which shows the progressions of the above mentioned skills and which is related to the objectives in the curriculum, we can also show the pupils exactly what it is that will be assessed. This leads to an increased validity in the assessment process. The assessment grid is also a good help for the pupils to understand the feedback they get and when they evaluate themselves.

The pupils write about their ideas, the teachers and the pupils give each other feedback and ask follow up questions. A great help for the teacher, and a great incentive for the pupils, is when you invite experts to participate in the discussions. On one occasion, we chose to invite a policeman who joined the discussion about law and order. The pupils were then able to ask him questions regarding underage consumption of alcohol and drugs. They discussed why some people end up in criminality and other related topics where his experience and special training was of help. Another expert who joined us was a university professor in the science of religion, who contributed with many new sources and perspectives regarding xenophobia and immigration.

The role of the teachers and/or the invited expert is to guide the pupils in their development of the skills and not to get involved in debates with the pupils. At first, our project was meant to be used to develop and deepen the classroom discussions about subjects such as xenophobia, human rights and equality, but we soon realized that this dialogue based forum was an extraordinary arena for language learning. By giving the pupils instant feedback, and, thus, instant possibilities of practising and developing their language skills, it proved to be a formative way of working. Thus, the teacher works on several levels – on the one hand, he guides the pupils in the discussion and helps them develop the above mentioned skills, and at the same time, he can help them advance in their language use. We wanted to be able to identify the pupils' strengths and weaknesses in their language use, and we wanted to be able help them take the next step in their language development, by giving them constructive feedback during the working process and by allowing them to use their new knowledge immediately. We have chosen to call this a formative dialogue method.

We have also created a support structure to help the pupils in the discussions and the teacher in their feedback. On the one hand, the support structure explains how you can approach a topic using the skills mentioned above (analysing, using sources, arguing, using central concepts etc), and on the other hand it breaks these skills down to help the pupils understand them. For the teachers, this structure is a great help since it points out what the feedback can focus on in order to help the pupils develop their skills.

3. The scientific basis of the dialogue method

We got the inspiration to the dialogue method from the Norwegian professor Olga Dysthe and her work "The multivoiced classroom". Dysthe points out a couple of important parts in the dialogue method. [2]

Secure within the group

At first it is important to create an environment in which all the pupils participate and contribute in the learning process. Pupils, who do not feel secure within the group, are less likely to participate, and, in consequence, also less likely to improve their language skills. Therefore, we have chosen to use a closed network where only those invited are able to participate.

The topics

Secondly the questions has to be open and authentic. An open question is a question that does not have any given answer and that provides and encourages the opportunity of having different points of view. A potential problem with this kind of questions is that the teacher might end up assessing the wrong things.

In order to minimise that risk we use the above mentioned assessment grid. An authentic questions is related to the pupils lives. For example we have had discussions about ideals, peer pressure, grades and how and why girls and boys are treated differently.

Different types of feedback

Another essential part of the dialogue method is the continuous feedback. We work with feedback on several levels. The feedback always concerns a skill that the pupil is meant to develop as opposed to being personal. One type of feedback focuses on the language development of the argumentation linked to the subject. This can for example be advice on how to present your opinion in a clear and convincing way using paragraphs and conjunctions. Another form of feedback has to do with the ability to look at a problem from different points of view or to use different sources to deepen the argumentation and to support your opinion. Given the right feedback, the discussions may lead to a higher order of thinking, as seen in Bloom's taxonomy. The virtual classroom is a suitable arena for giving process oriented types of feedback.

The feedback from the teacher is very important, and in the Swedish anthology Språkboken [3] the advantages of teacher feedback is emphasized, by pointing out that it gives the teacher a chance to individualize the teaching, to see what kind of help each pupil needs when it comes to content and formalities. The teacher also has the opportunity to show the pupil how to give good and constructive feedback, that is, the teacher is the role model. We believe that this method is very rewarding when it comes to practicing language skills.

Self and peer evaluation

Dysthe argues that the pupils must listen to each other, for example by using other pupils' ideas as a means to develop their own speaking or writing skills. The pupils may refer to what their classmates have said or written, and by doing so they can develop an argument or contradict it. When pupils get used to the method we have noticed that they start to learn from each other. Since the pupils can read all the classmates arguments and feedback they start evaluating themselves by comparing their own arguments to the classmates arguments and feedback. When they start to comment on their classmates arguments they also start a process of peer evaluation. [4]

3.1 The formative method

The formative method is integrated in the dialogue method. In order to be able to develop the pupils' language skills by using a formative method, you have to make sure that these crucial requirements are met:

First of all, it is important that the pupils understand the assignment. Secondly, they have to be made aware of where they are in relation to the objectives, and thirdly, they must be familiar with the objective and what is going to be assessed. The assessment should be an integrated and repeated part of the learning, and it is supposed to help the pupil take his or her next step of development.

4. Evaluation

In Sweden, many schools face the challenge of 1-1, which means that each pupil will get their own computer to use in their school work. To meet this challenge, we need to apply teaching methods that has proven to work and that are in line with our steering documents. The new technology has many possibilities and requires new teaching methods. In the SAMR-model, the American Ph. D. Ruben R. Puentedura, describes how the teaching undergoes four stages when schools implement new technology. In the first two stages, nothing really happens. The computer is simply another tool, used to carry out the usual assignments. In the last two stages, the teaching changes and the content become palpable. Puentedura describes these stages as the teacher modifying and redefining the teaching.[5]

When we use the formative dialogue method, discussing topics in an Internet forum, the pupils have the possibility of reading and re-reading what they and others have written and they can verify the message or contradict it by using other websites or sources. Since we, as teachers, also have the opportunity to comment on the pupils thoughts, they get immediate feedback from many readers and the chance to use the tips right away. The instant response can be compared to a normal classroom activity in which it can sometimes take a long time between the feedback and the next attempt to work with a skill.

In our work, we have been able to conclude that a virtual classroom is democratic since it favours pupils who are not outspoken and who do not have a high status within the group. In a normal classroom debate, these pupils are sometimes invisible, but online many of them feel more secure and are a lot more active. This is of course beneficial for the entire group. Thus, it is fair to say that the use of social media in the classroom is a way of creating the environment Dysthe talks about in her theory. The discussions in social media facilitate a varied language practice by means of a formative dialogue method. Since it is fun the pupils are very active, even when you do not expect them to be.

Another advantage compared to a classroom debate or discussion is that the pupils are offered more time to interpret the questions, use external sources and reflect.

Yet another advantage is that the pupils are given repeated opportunities to practice and develop their skills. For the teacher these repeated discussions leads to increased reliability concerning the assessment. Furthermore, the variety of topics offer the pupil a possibility to participate in discussions they find interesting.

When the pupils start to communicate with each other, there are often examples not only of peer appraisal, but also of critical questions, for example concerning the facts that were used to support an argument. Apart from strengthening the language skills and the knowledge in the subjects, the work in the social media also strengthened the communication between pupils in real life.

We aspire to develop the method by emphasizing self- and peer evaluation as well as peer-to-peer-feedback. We also aim to involve the pupils even more when it comes to selecting the topics for discussion to make sure that they are authentic. By discussing topics close to the pupils' own lives and interests, we hope to increase their activity further and to give better, individual feedback. Another possible way of developing the work is to cooperate with university students who are preparing themselves to become teachers and to let them do some of their work experience in the virtual classroom.

The Swedish curriculum also points out that :

"Language, learning, and the development of a personal identity are all closely related. By providing a wealth of opportunities for discussions, reading and writing, all pupils should be able to develop their ability to communicate and thus enhance confidence in their own language abilities" [1].

By using social media in the classroom, we have now found the arena where we can provide the pupils with the above mentioned range of opportunities to discuss, read, write and reflect.

Final words

As we look into the future, we feel that the formative dialogue method we use will be of great help when it comes the skill-based education described by Daniel Clark, Programme Leader for the BSc in Leadership, Enterprise and Management at BPP Business School. In his article "Social Media: Why this Matters To Everyone In Education" Clark points out the necessity of using the same kind of tools in school as the pupils use in their everyday lives. [6]

Our method, which is in a closed forum, provides a secure environment for the pupils where they can express their opinions and practice their skills again and again with qualitative feedback, and we believe that students at many different age levels can benefit from using it.

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Below, we have gathered three different responses from the same student, although from three different topics. Between the students responses we have written some examples on how we would give feedback, and tried to explain how we think when we try to help the student develop the skills expressed in the curriculum. This particular student has been using our method since she began year 7 (when she was 13 years old), and she is now in year 8 and we can really notice how she has deepened and developed her way of arguing, using sources, using central concepts and looking at topics from many perspectives.

Example 1 - early on in year 7. The topic was “Why do girls do better in school than boys?”

I don’t think that you can say that girls are treated better than boys in general. Sometimes it can be like that in school, but when people start working boys often get a higher pay than girls. I almost think that weighs up for the unfair treatment in school. But I also think it is unfair that teachers and parent are more inclined to believe in girls than boys when something has gone wrong.

Here is a link where you can read more about this.

http://www.sydsvenskan.se/sverige/article621066/Varfor-har-tjejer-b...

Teacher’s feedback

After a comment like this, our feedback would concern the following things: 1) Use the source in your comment next time. That means that you should say something about what is in the source and why you have chosen it instead of just referring to it with a link. 2) Make sure you begin your comment with a very short introduction explaining the topic and what you will write about.

3) Remember to divide your text into paragraphs.

Example 2 - early in year 8. The topic was “Would it be a good idea to eat vegetarian food once a week in school?”

There is a proposal that we should eat vegetarian food in school one time per week. Is this a good or a bad proposal?

According to the nutritionist Åsa Brugård Konde it would be good to reduce the amount of meat we eat, it would be better for both the health and the environment. Now, we eat about 85 kilos of meat per year and person, and since 1990 this amount has increased with 25 kilos which is a lot.

“Reasons for eating more meat can be that it has become cheaper, but also that we have more money to spend”. You can find more about this on this web page:

http://www.metro.se/noje/svensken-ater-sin-vikt-i-kott-varje-ar/Objiaz!23_0145-65/.

On this page they ask the question if we should stop eating red meat altogether to avoid cancer. The answer is that one shouldn’t “stop eating red meat, but rather have a moderate consumption”. They also point out that we need to have a balanced diet with a lot of vegetables and that one has to exercise regularly to avoid cancer.

http://www.svensktkott.se/faq-naring/ska-vi-sluta-ata-rott-kott/

If you stop eating meat it will become more difficult for farmers to support themselves since they make money from breeding animals for slaughter, so if we eat less meat than before they won’t make as much money as they used to.

Teacher’s feedback

In this case the feedback would begin with praise to the student who has made progress since last time. The students comment starts with a short introduction to the topic and the question which will be discussed. Furthermore, the student looks at positive as well as negative things with the proposal which is one of the skills pointed out in the Swedish curriculum. The student has also used different sources. To further develop the skills the student should focus on the following things: 1) Try to weigh the positive and the negative things to reach a conclusion in a more developed line of arguments. 2) Use the sources more actively in your line of arguments, rather than merely pointing them out. (In this case the teacher would show the student how to make quotations and give references in a text which enables the student to use the sources).

Example 3 - in November in year 8. The topic was “Should we have homework in school?”

One of the questions we discuss most is about homework. Do we need homework? What constitutes a good and meaningful piece of homework? Is the homework an important part of the education?

The advantages with not having homework is that I would be able to do in the afternoons, I can practise my sports and instruments more, hang out with friends etc. Most people I know don’t make their homework until the night before it’s due which leads to a lot of stress.

If you need help only your parents can help you, and since they often don’t think the same way we do in school, they can’t help out most of the time. If you take maths as an example, my parents use division in a completely different way than we do in school, so when we try to make homework together we don’t understand each other. That makes me annoyed with them, which makes the atmosphere at home worse than if there were no homework to argue about.

“Knowledge is not something you show at a certain date” explains exactly how I feel about this. You shouldn’t have to study something and learn it in a week, as is often the case in school. It is better if you work with it for a longer period of time in class with a teacher - then it “sticks” better in my brain, at least. Here's a link to the newspaper writing about this:

http://fof.se/tidning/2010/2/laxor-for-livet-eller-i-onodan

At many schools they have gotten rid of homework altogether. "I don't understand why we should have homework just for the sake of having homework. It is far better if the students work with the assignments during school hours. It is not always the case that the students can get help with their homework at home." says Berit Wikmna, the principal at Botkyrka private school.

I think that what she says sounds good, because it means that I would have more time to do what I want after school, and that I wouldn't have to worry about homework. Here is more about the school and how they work:

http://www.fria.nu/artikel/80879#ixzz2BesnckpO

The positive thing with homework can be that there might be something you need to practice more, for example if you risk not passing a certain subject. However, I don't think that all students should have the same homework. It would be better if each individual got the homework they need, so that you get to do something meaningful.

To summarize, I would like to say that if the homework is not individual and designed to help the student become better at something they need, it is not necessary.

Teacher's feedback

In this last comment, the student has developed her skills using the feedback given in the forum and in the classroom. Her introduction is better and the question is presented through several relevant questions that adress more than the pros and cons with homework, but also shows that the student has understood that the question is far more complex than the class thought at first. The student uses the sources in a better way than before, she shows that she is learning to refer to the sources correctly. The student still refers to some sources without using them actively in her line of reasoning. Unlike her early contributions, the student is now more intellectually active in the reasoning. She examines the topic from different perspectives, both her own point of view and the views expressed in the sources used.

However, we would still try to give feedback in order to make the student reach an even higher level of reasoning. An example could be to try to find sources that illustrates many different sides of the question.

This text was written by one of our former students, Victoria Karén:

"My name is Victoria Karén and, when I'm writing this, I'm 18 years old. I was one of the first students ever to try this excellent educational method created by Martin Löfgren and Per Ahlkvist.

As you may already know, this blog/site was a way to make the students express their own thoughts and arguments about all kinds of topics. It was supposed to make it easier for the students to really think about how to express themselves, observe and to give us a chance to find source references that we could base our facts on.

When we were introduced to it at first, we just saw it as another assignment that we had to agree on. But as the time passed, we noticed that it actually was a lot of fun and you started to log on by yourself without having anyone telling you that you had to. We got into a lot of heated discussions, and some topics even had “guests” invited (as for example a police man or a teacher from another school) so that we could see things from another point of view.

I think that everyone was amazed by what everyone accomplished. Classmates that hadn’t gotten the chance to open their mouths (because of the much uncontrolled oral discussions in the classroom) suddenly had a lot of thoughts on their mind that they wanted to share.

Another thing that I was struck by was the maturity that hit our arguments. Instead of scrappy texts that lacked fact, they suddenly turned into structured writings. These writings included source references, arguments that showed more than only one version and our own thoughts.

Thanks to this educational tool, it became easier to both write and perform discussions when I reached upper secondary school. We learned how the text should be constructed to reach higher goals, both on theoretical tests and oral.

I must say that this really was a great idea and I wish that we would have something similar in school now. Since the teacher/teachers choose the topics and subjects themselves, it becomes suitable for every age.”

/Victoria

This text was written by another of our former students, Daniel Johansson:

I thought that the system we tried with Per and Martin was brilliant, and modern. Most youths spend a lot of time on their computers when at home, perhaps instead of studying. Therefore it was an advantage that the forum we used for discussing and arguing, was over the internet. It was very smooth, being able to just log in to the forum to write something, and at the same time doing homework that perhaps would not have been done if it was not on the computer!

So for the “lazy” students that chose the computer before homework, this system was amazing.

I also think it was great due to the fact that maybe some students are too shy or nervous to raise their hands, and say something in the class at school, got to have their saying over the computer where no-one could judge them.

The fact that we hired in experts in different subjects on the forum was also brilliant. Instead of having to pay them to show up at school, they can just as the students, log on to the computer and write.

My arguing skills definitely improved, because I was able to argue about what I wanted, when I wanted.

I have had use of these arguing skills not only in schools, writing arguing texts, but in real life as well. Practicing arguing definitely improves your ability of discussing.

The system of having a forum on the internet for students to discuss and getting evaluated by the teachers, was truly amazing. It brought out qualities from shy students that perhaps would not have been seen by the teachers, if the system did not exist.

Biochemians Got Talent: Student Assessment Through YouTube Video Presentations

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Abstract

The University of the West Indies, St. Augustine campus, Trinidad and Tobago, offers a wide range of biochemistry courses for both our Biochemistry and Biology majors. However, our introductory biochemistry courses have been beleaguered by pass rates as low as 45%. In 2011 we introduced a new biochemistry course, BIOL 2365, which had a strong blended learning approach. In its introductory year this course obtained a pass rate of 77%, the highest pass rate of any introductory biochemistry course in the Department of Life Sciences over the past 5 years. In 2012 we encouraged our 155 students to innovate, imagine and create. They were given a semester long (10 week) video project, "Biochemian's Got Talent", where they were required to work in groups of 5 and make 15 minute videos on any topic from the syllabus. 31 videos were produced and uploaded on the course instructor's BiochemJM YouTube channel for worldwide viewing. Feedback questionnaires were provided to the students in the 12th week. Most students (94%) indicated that this was an enjoyable learning experience. Students reported increased knowledge about copyright laws as well as improved communication, social and leadership skills and they had a greater appreciation of the topic through the expression of their creativity as well as that of their peers. The majority of students (>80%) found the size of their group and the time given for the project adequate. Students (>90%) also found the video project an appropriate form of assessment and recommended this form of assessment for other courses. The pass rate for BIOL 2365 increased to 91% in 2012.

1. Introduction.

Trinidad and Tobago is a twin island democratic republic consisting of the two most southerly islands in the Caribbean archipelago. Trinidad, the larger (4,828 sq. km, 1,864 sq. miles) of the two islands, is located approximately 10km (7 miles) northeast of the coast of Venezuela [1]. There are four major tertiary institutions [2] in Trinidad with The University of the West Indies (UWI), St. Augustine campus being the first established (1960) [3]. Education is free for all Trinidad and Tobago citizens from the primary to the undergraduate tertiary levels [2].

The Faculty of Science and Technology (FST), UWI, offers a wide range of biochemistry courses for both our Biochemistry and Biology majors. However, our introductory biochemistry courses have been beleaguered by pass rates as low as 45%. This may be due in part, to a significant increase in class sizes and that many students entering the tertiary system are not equipped emotionally or academically to handle the rigors of tertiary life. Educators must also share some of the responsibility. We needed to critique and in some cases change our methods of delivery as well as assessment for todays' students [4].

BIOL 2365 Comparative Biochemistry is a Level 2 semester 1 Biochemistry course that was first introduced in the 2011 – 2012 academic year. Most of the lectures were available as YouTube videos via the course instructor's BiochemJM YouTube channel [5]. Coursework was continuously assessed using group projects, case studies and online quizzes instead of the traditional one hour written incourse exams given twice during the semester. The pass rate for the final exam was relatively high at 77%.

In the 2012 – 2013 academic year, the objective was to improve student learning. Once again students were given access to all lectures via the BiochemJM YouTube channel [5]. They were given case studies and online quizzes. Additionally, students were encouraged to imagine, create and innovate. We anticipated that this would inspire them to go beyond pen and paper, chalk and board and use their higher order thinking skills to explore the course material. As such the students were given a semester long (10 weeks) project, Biochemians Got Talent (BGT), where they worked in groups to create videos covering any topic on the BIOL 2365 syllabus. After completing this project students were expected to acquire the following skills:

i. Apply critical thinking and creativity to explain selected biochemical concepts.
ii. Demonstrate effective communication skills in the areas of interviewing and presenting.
iii. Demonstrate project management skills and actively use videos as a medium for positive student expression.
iv. Brainstorm and design themes and content for their videos.
v. Complete pre-production and production of their video and create a high-quality video.

We used the term 'Biochemian' in this course to describe an individual who learns biochemistry in a fun way.

This paper will serve as a guide to develop and assess video assignments at any educational institution.

2. Methods.

This BGT video project was implemented from September 2012 to November 2012 (Semester I 2012 – 2013). The following UWI institutions approved this project: Instructional Development Unit (IDU), Department of Life Sciences (DLS) and Marketing and Communications.

Groups of five students made 15-minute videos covering topic(s) or concept(s) taught in the BIOL 2365 course. These videos incorporated songs, skits, cartoons, puppets, interviews, tutorials and debates [Appendix 1]. Students selected the members of their group. Each group elected a project leader who met with the course instructor to discuss the progress of their project. The project leader also dealt with any administrative matters on behalf of the group.

An instructional manual detailing (i) the objectives and goals of the assignment, (ii) software to use, (iii) important dates of submission, (iv) rubrics and (v) copyright guidelines were posted up on the UWI's BIOL 2365 Moodle site at the beginning of the semester. BIOL 2365 students had full access to this document. The details of the assignment were discussed with the students during their first class of the course and they were asked to consider these important questions before starting their video project:

i. What is the purpose of the video?
ii. Who is your desired audience?
iii. What topics/themes should be covered during the recording?
iv. Who will work on each portion of the video?

In week 1 of the semester project leaders submitted names and student ID numbers of members of the group as well as a working title for their project (refined throughout the semester). In week 2, at least 2 members of each group met with the course instructor to discuss their project. This was a 15 min meeting discussing the general plans of the project and what resources the group would require and use. This was to ensure that the students were on the right track.

By week 3 project leaders submitted a group project outline containing the following: objectives, biochemical themes / topics to be covered in their video, a brief procedure, a list of resources being used and the contribution of each member in the project. This exercise was assessed. A detailed rubric outlining how marks would be awarded and what would constitute an excellent, good, and weak outline was provided in the instructional manual. Project leaders updated the course instructor on progress of their project on a biweekly basis. This was done via email or Facebook or Skype.

The students used the following programs for this project: Microsoft MovieMaker, Powerpoint, Keynote, Camtasia, iMovie and YouTube GoAnimate. Groups submitted their videos in the tenth week. Videos were marked using a detailed rubric and uploaded to the course instructor's BiochemJM YouTube channel [6].

Questionnaires designed to obtain student feedback about the project were provided to BIOL 2365 students in week 12. The questions were mostly open-ended. Students were informed that their participation was voluntarily. All information was kept strictly confidential. Data was analyzed using IBM SPSS Statistics v 18.0

3. Results and Discussion

One hundred and fifty five students were registered for the BIOL 2365 course in Semester 1, 2012 – 2013. Thirty one videos were produced [6]. Ninety three percent of students doing BIOL 2365 answered the questionnaire. There were more female than male students in the class (71.3% Females vs. 28.7% Males), which is representative of the general UWI student body. The average age of this cohort was 21 yrs.

The majority (84%) of students reported that they learnt new skills or improved on existing skills while doing this project. New skills obtained included the (i) use of video editing software and (ii) filming, directing and acting. These are skills that are not typically gained from a biochemistry course but could be an asset in their careers.

Students thought that this project improved their (i) social skills (they learnt how to work in a group), (ii) leadership skills (sorting out conflicts in groups) (iii) Powerpoint skills (iv) self-confidence (v) time management and teaching skills (vi) writing, accessing and analysing data. Students also reported that this group project taught them patience working in groups and they were able to forge new friendships.

The majority of students (71.3%) said that there were unforeseen benefits from this project. Students reported that they learned more about copyright laws, improved communication skills, developed leadership skills, became more social, understood that complex biochemical process can be made simple, discovered skills using a camera, overcame stage fright and increased their enjoyment of biochemistry.

This project required that students work in groups of five. However 17.5% of the students reported that they would have preferred to work alone. Their reasons were as follows: there were too many conflicting ideas, personal schedules between group members clashed and as a result were unable to come together, additionally group members refused to complete their assigned tasks.

One of the major challenges with group work is delinquency. While this cannot be totally prevented it was emphasised during the orientation session on the first day of class that all members of the group were required to participate equally in this project. Students were encouraged to report any form of delinquency to their course instructor with the assurance that all information would be kept strictly confidential. The course instructor interviewed delinquent students and if found guilty, a deduction to the student's mark was made. Two groups experienced problems with delinquency. Their matters were resolved using the above protocol. There were some groups that did not bring delinquent members to the instructor's attention and this led to dissatisfaction amongst group members.

The majority of students (82.5%) acknowledged merit in group work. They preferred to work as a group because the workload could be divided amongst group members. They also recognized that other group members could provide skills such as video editing and musical talents that they did not possess and a wide range of ideas would contribute to a high quality video. Some students indicated that other members of the group were able to explain biochemical concepts that they did not understand.

Most students (85%) found that 5 group members were adequate. They found that the workload was evenly balanced and that fewer members would have made the project too demanding while more members would have lead to a conflict of ideas and too many individuals to agree on decisions. 15% of students suggested that the group size should increase. They indicated that more people were needed to successfully complete their video projects. In future the policy of 5 members per group will be maintained. Groups are allowed to include extra individuals from outside the classroom, if necessary, to assist with the videotaping and to play 'extras' in the video.

This was the first time a project of this nature was undertaken at The UWI. 92.1% of students agreed that the video project was an appropriate form of assessment and would recommend this form of assessment for their other courses. Student feedback is listed below:

(i) 'It is a very different and exciting approach towards learning material'

(ii) ‘Because it expresses creativity but at the same time allows you to venture into different learning methods instead of just learning or having to always follow from power point’

(iii) ‘It was really fun and it was a new and interesting way to learn the work’

(iv) ‘Gives a hands on approach to course material. It's fun & new & interesting’

(v) ‘Enables better understanding of the topic as it promotes interest in the topic due to the creative aspect.’

(vi) ‘Because it gives a chance for science students to express creativity when we are accustomed to doing labs with strict procedures.’

(vii) ‘It was fun- Allows us to learn a skill other than inforamtion regurgitation. It allows us to interact with the information ie get involved; translate it fron a textbook to everyday life.’

7.9% of students said that this project was not an appropriate form of assessment. They believed that it was worth too much of the final exam mark (the project was worth 10% of the final exam mark). After assessing student feedback the weighting of the BGT project will be raised to 15% of the final exam grade.

Students were asked if they would be comfortable collaborating with other students on their videos. The objective being, to develop a peer review learning system where students from other universities can view and comment on our students’ videos and subsequently encourage students from other universities to make videos of their own. The majority of students (94.2%) were interested in the idea. They were interested in providing a different approach from the textbook to explain biochemistry to other students and get their feedback. They liked the idea of representing their university and country and show off their skills. Students who were not in support of the idea (5.8%) said they were too shy and felt embarrassed to be recorded.

When asked, ‘What did you like **<u>LEAST</u>** about this BGT project?’, most students left that section on the questionnaire blank. Those who commented said that they did not like group work and that using editing software was difficult as well as the project was too time consuming. It should be noted that these responses represent a minority of students e.g. 7.6% of students thought they did not have enough time to do the project.

Students responded favorably when asked, ‘What did you like **<u>MOST</u>** about this BGT project?’ They liked that they were able to choose their own group members and topic. They appreciated that the project allowed them to learn and understand in their own way. It was an escape from the monotony of assessment that other courses used. The students liked acting and filming. They appreciated that this project allowed them to use their creativity to fully understand the topic.

Finally, the students were asked, ‘How can this project be improved?’ Some students had suggestions while many did not answer. The suggestions were as follows: to increase the weighting of the project to 15%, provide more video cameras, show students how to make a video and how to edit, make the length of the video shorter and allocate topics. From these suggestions the following is being organised for next academic year (i) a private photo studio has volunteered their time and resources to assist students with their projects, (ii) detailed instructional videos on how to create and edit short videos will be provided and (iii) a smartroom is under development at the University that will be equipped with video and audio equipment that students will have access to.

Giving students a certain level of flexibility to choose their own group members and select a topic was essential to increase their level of comfort and successfully complete the video project. It was important for the project's success that the students enjoyed the process. Ninety four percent of students said that they enjoyed the experience and were happy that they completed the project. The majority of students (80.3%) reported that the BGT video project increased their self confidence in doing the course.

All videos were uploaded to the instructor's BiochemJM YouTube channel [6] and made public. The students shared the view that knowledge should be made available to all freely. Anyone with an internet connection can view and learn from these videos; 25 thousand views from over 40 countries have been recorded so far.

These videos will be used as teaching tools for future BIOL 2365 classes. 64.1% of the students agreed to mentor next years' BIOL 2365 students with their BGT video project. Many of our graduates go into secondary level teaching. This course can equip them with additional tools for teaching that can revolutionize the education system from the ground up.

Although not initially planned, the student's efforts were so impressive that they were awarded with prizes. [Appendix 1]
1st Prize: Sweet Assassins [7]
2nd Prize: Say Beta Say Keto [8]
3rd Prize: Ah Bit Ah Oxidation [9]
4th Prize: Told stories of the RE [10]
Best Song: The Beta Oxidation Rap [11]
Best Fight Scene: The Enzyme League [12]
Most Popular Videos: The Enzyme League [12] and The Biochemables [13]

4. Conclusion.

We asked our students to innovate, imagine and create. Their responses exceeded our expectations. They used puppets [14], fight scenes [12], horror [15], music [11] and cartoons [16]; [Appendix 1]. The students effectively applied critical thinking skills and creativity to explain complex biochemical concepts. They were able to effectively produce a high quality video and we can safely say that this project was indeed a success. We believe that the video project played a critical role in increasing the pass rate from 77% in 2011 to 91% in 2012. We strongly recommend that educators implement a similar project in their courses.

5. Acknowledgements.

BIOL 2365 students (2012 - 2013)
Ms. Neisha Ramroop and Ms. Shivani Boodram for data entry.
Dr. Kristy Reynald for reviewing the paper.
DLS, UWI for their support and guidance
Prize sponsors: Dr. Kristy Reynald (1st place prize), The Department of Life Sciences (2nd and 3rd and 4th place prizes), Dr. Nigel Austin (Best Fight Scene), Dr. Valarie Bowrin (Best Song), BiochemJM (Most popular YouTube video)
Instructional Dvelopmental Unit, UWI for their support and guidance

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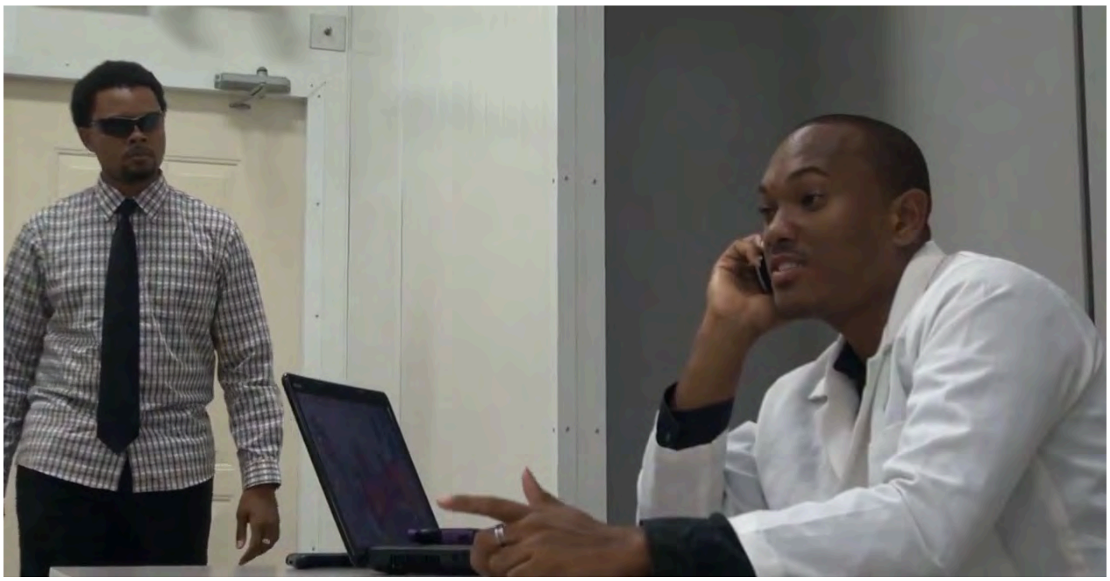
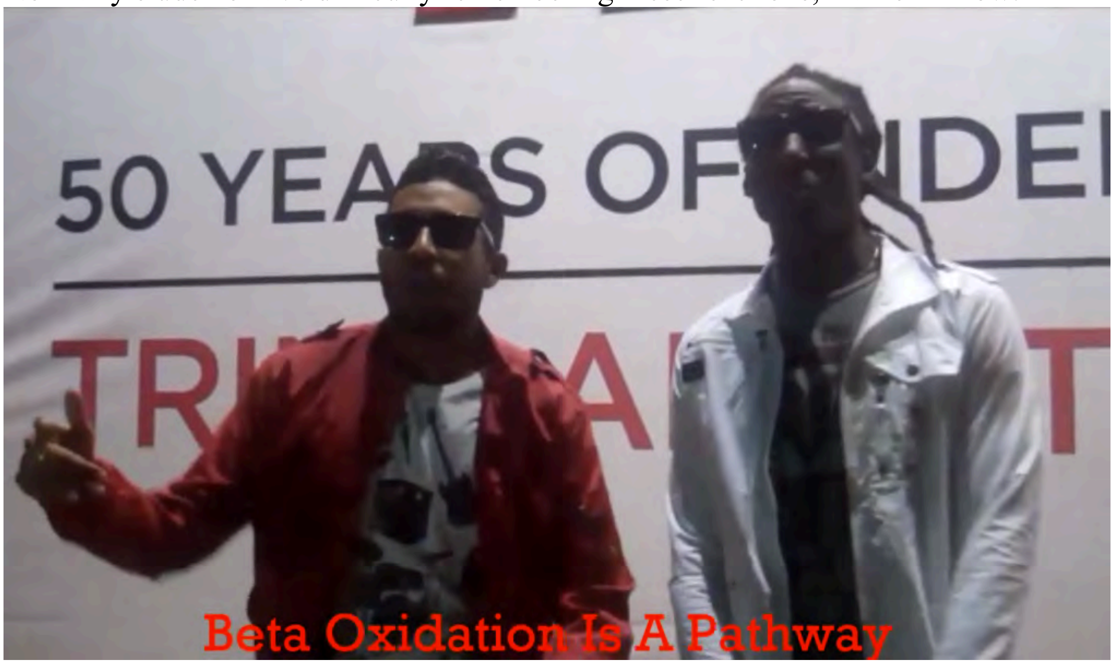
14. The BiochemJM YouTube channel. Parliament Melee. Accessed March 17, 2013. http://youtu.be/8e8y-bKthws
15. The BiochemJM YouTube channel. Monday 12th. Accessed March 17, 2013. http://youtu.be/3GYsRfqR3PA
16. The BiochemJM YouTube channel. S.M.A.K.S. Accessed March 17, 2013. http://youtu.be/TA3o80aaSnQ

Appendix 1
Illustrative screenshots from selected BGT videos.

Sweet Assassins [7]
When the dangerous metabolic disease diabetes, initiated by the evil Dr. Sweetness, affects Little Fatty it is up to the legendary Inspector Nurse and his team to help Little Fatty through the ordeal and bring Dr. Sweetness' plan to a crushing end.



Best Song: The Beta Oxidation Rap [11]
A rap song outlining the enzymatic reactions involved in fatty acid beta oxidation. Normally students have difficulty remembering these reactions; that is till now.



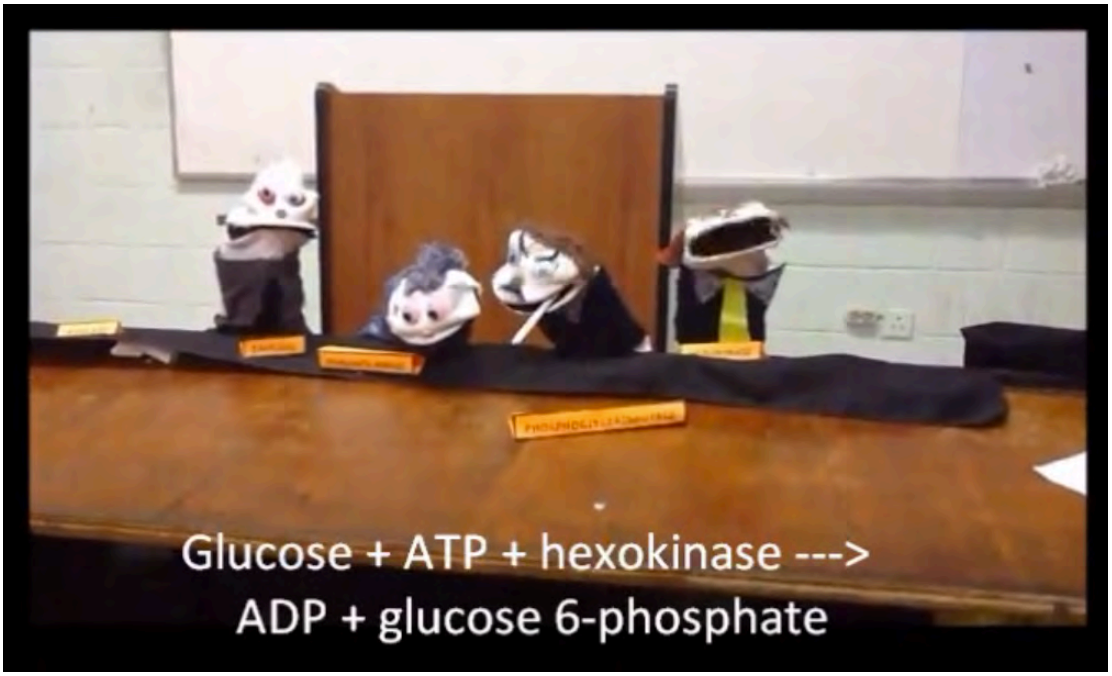
The Enzyme League [12]

After being embarrassingly rejected by the elite Enzyme League, the formidable Sam the Inhibitor intends to exact his revenge by destroying their power source, the Pyruvate Dehydrogenase Complex (PDH). Not only is this complex responsible for the League's power but for all the PDH complexes of the world. Since the PDH complex catalyses the step that links glycolysis to the citric acid cycle for cellular respiration to occur, the destruction of the complex would wreak havoc on the world. Upon hearing this, the Enzyme League seeks to understand the mechanisms involved in the complex's reactions and stop Sam the Inhibitor, ultimately saving the world!

The Biochemables [13]
A team of highly trained and qualified biochemistry students embark on a mission to help a UWI biology/ environmental major student make the most important decision of her life. In order to do this the team uses all their biochemistry skills to tutor her on a topic called "The Urea Cycle".

Parliament Melee [14]

When the "Republic of JM" goes into a state of fasting, the enzymes of the Glycolysis Party (GLY), which usually governs the country, present their budget plan for maintaining blood glucose levels and providing energy, in parliament. The opposition Gluconeogenesis Party (GLU), however, has a few issues with the GLY Party's plan.



Monday 12th [15]

This is a parody to the horror movie 'Friday the 13th' where the sock puppet, Jason M, visits a group of biochemistry students who decided to spend their weekend at a beach house instead of doing their biochemistry project due Monday 12th. They are each asked a question by Jason M, the answer to which decides whether they live or die.

You too sweet for me the diabetes dilemma [16].
This is an animation aimed to educate the public on diabetes. The video begins with Max, an obese man whose wife is unhappy due to Max's impotence. She signs them up for a talk show called "Name your disease" and there, other characters are introduced. Sheila is a middle-aged woman who is always tired and Charlie is a young man who is losing his vision. Dr. Hernandez, Dr. Persad, and Dr. Chen provide insight into the biochemistry of their disease.

BGT Prize Giving Function

Some of the students involved in creating the BGT videos

Innovate – Social Media and Open Source in Higher Education

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Abstract

This paper initiates advanced learning and teaching through the Social media tools such as Face book, Twitter, YouTube, Blogs, Google+, Geogebra and etc. This paper describes how it works, where it is going, and why it matters in an emerging country-India particularly. It also supports the teaching and learning community in developing ways to gather evidence of the impact of social media tools innovations and current practices on learning. There is already evidence that teachers are using social media as part of teaching strategies, with the aim of encouraging students to view social networks as less of a pleasurable distraction. With this paper we are trying to integrate social media into the classroom, and focuses on the need to carefully review existing teaching strategies and understandings of social media before making changes. It is a scoping point to reach quality of education and get better results in India.

Keywords*: Face book, YouTube, Twitter, Wiki, Blogs, Learners TV, Khan Academy, Geogebra and iTunes.*

1. Introduction

Social media are online tools and free of cost platform which allows users to create interactions among people in which they share and exchange information and ideas in virtual communities and networks. Actually, Social media tools save time when used effectively. Now the young generation is internet generation, they can access limitless information from fundamental and related Information. Social Media offer a wide range of benefits for students and lecturers: a potentially cheap and efficient way to link students with their lecturer and vice versa.

The chance to monitor real-time progress on problems and solutions, assignments and projects etc. and the ability to connect anyone from remote parts of the world to share ideas, experience an effective teaching practice. In 2013, India reached the third largest internet user - with China and the US taking the first two, respectively. It is absolutely known that with the present education system in India having second highest population in the world internet plays an important role. According to the survey from UGC (University Grant Commission) in India there are 634 award degree colleges and the growth of student enrolment in 2010-11 it reached to 70, 49,000 in Higher Education. It is observed 337 and 117 Noble Prize winners from United States and United Kingdom have very little populations and India there are only 7. In the *QS Ranking* 2012/2013, No University place top 200 from India. For example the most prestigious universities from India, IIT Delhi (212)

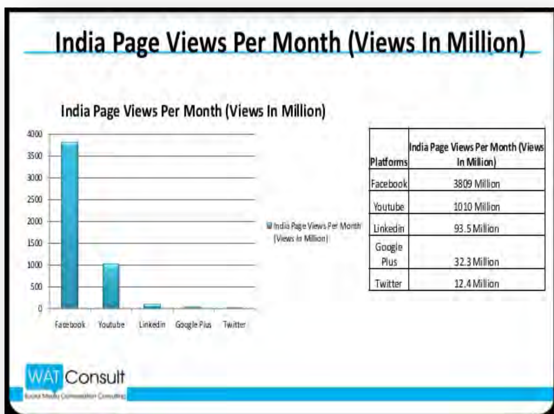

Figure 1 .WAT Consultant Report 2012 December.

From a report from daze info 2013 January, Social media users in India under the age of 35 years are the most active on social networking pages compared to people aged 36 to 49 years. Around 85% of people, less than 35 years of age, claimed they regularly check social media pages – classified into 40% and 45% categories of “Strongly Agree” and “Somewhat Agree” respectively. Female internet users in India are apparently more liberal towards Social media pages as 82% of them claim they check Social media pages regularly against 79% Male respondents. According to the Boston Business Journals May - 2012:Harvard was ranked No. 1 in part thanks to its Harvard Social Media Dashboard; Also ranking in the top 25 from Massachusetts is Emerson College (No. 13), Berkley College of Music (No. 22) and MIT (No.25).

2. Material and Method

A Survey conducted on Social media and open source, we have listed below few top social media and Open source tools which are mostly using by the students and lecturers

1. Face book(Lore)-Social network educational tool
2. Twitter-micro sharing site
3. Wiki-Collaborative encyclopedia
4. Blogs-Blogging tool
5. Learners TV-Free Online Video Lecture Courses on various subjects
6. iTunes and iTunesU-Harvard on iTunes U allows the University to distribute world-class educational content to the world at large
7. YouTubeEDU-Brings learners and educators together in a global video classroom.
8. Skype-Instant Messaging/VoIP Tool
9. (Edu) Glogster - Interactive poster tool
10. Edmodo - Edu social networking site
11. Voicethread - Collaborative slideshow
12. Animoto - Videos from images
13. Google Earth - Virtual globe
14. Voki- Speaking avatar creator
15. Geogebra - Maths software for schools
16. Wallwisher - Online noticeboard
17. Storybird - Collaborative storytelling
18. Khan Academy - Learning platform
19. Quizlet - Flash card and study games website
20. TeacherTube - Edu video sharing site

Recently we conducted a survey on social media tools and open source in various engineering colleges in India. The survey consisting of two points showing Figure2 and Figure 3

1) Main reason driving social media adoption in India
2) Students familiarity with social media concept

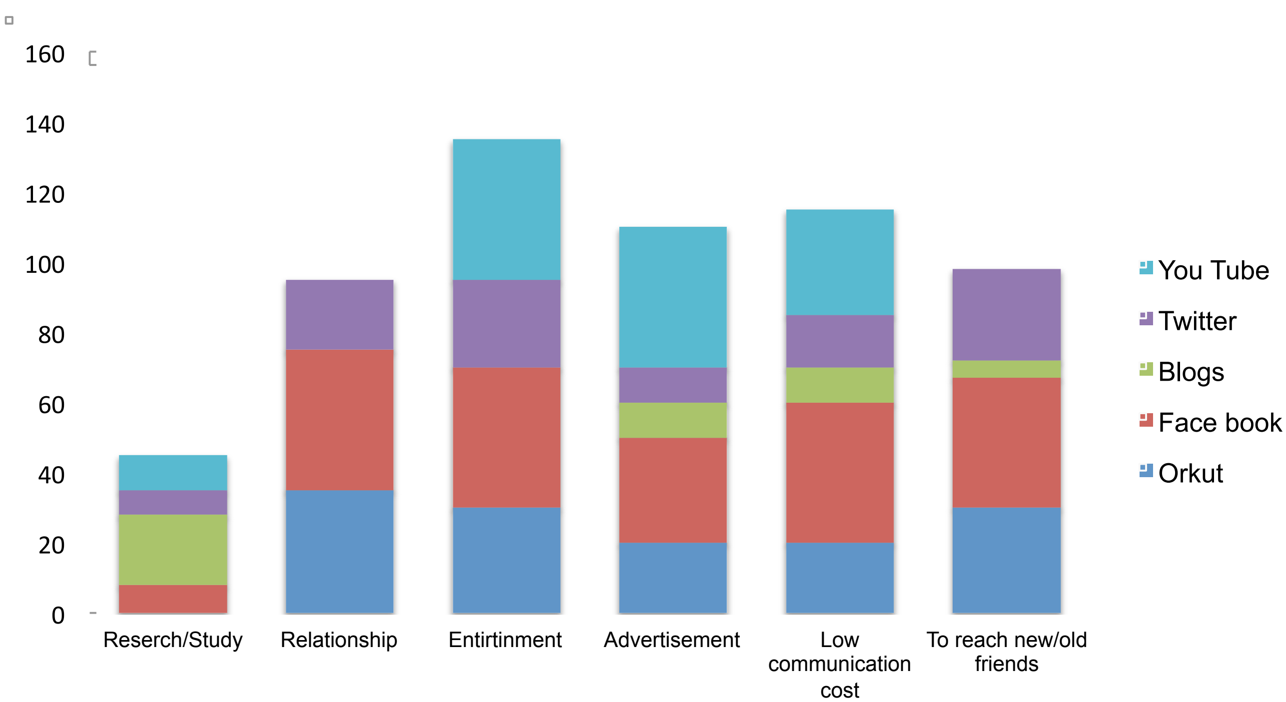

Figure 2.Main Reason driving social media adoption in India

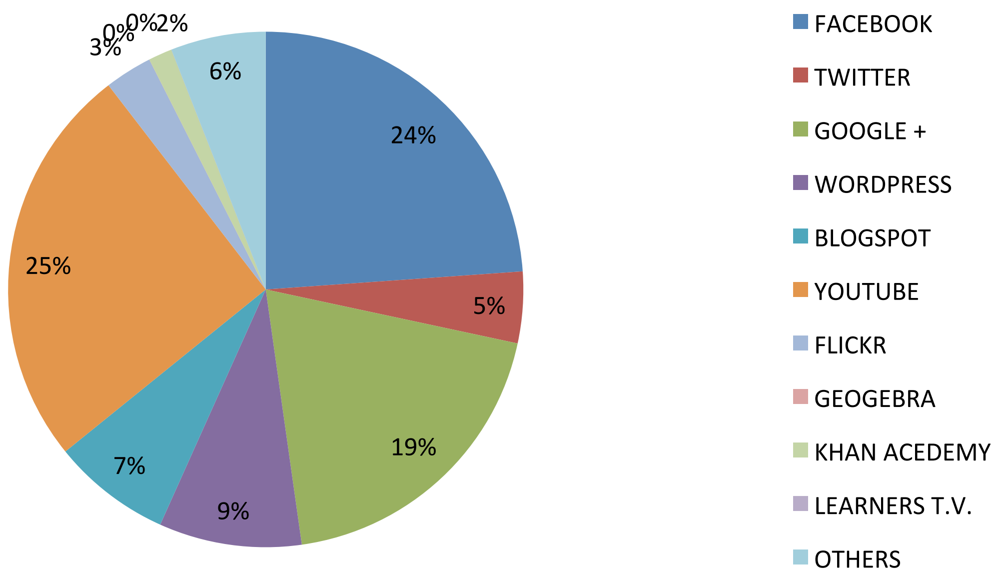

Figure 3.Students familiarity with social media concept

2.1. Face book

Based on the above Figure 1, Face book could be a wonderful tool for building a sustainable and life-long learning social network and building an extended community learning environment. Most of the students already have Face book accounts with their personal profiles setup. On their Face book wall, they have all sorts of information, including photos about themselves and their networking group. The biggest benefit of using Face book as a community learning tool as opposed to using communication tools in CMS is the continuity after the academic semester/school is over. Students will be able to keep in touch with classmates and even become connected with friend's friends. There are 61,499,220 Face book users in the India, which makes it 3 in the ranking of all Face book statistics by Country.

2.2 Lore

There's a new development with another educational social network. India is now in the top second using lore after USA.Taking a page from the early stages of Facebook, Lore is looking to change how teachers and students communicate. Lore wants to be a mixture of Edmodo, Blackboard, Facebook, Twitter, and Google+. Many people are going to flock to Lore in the coming months as it offers a wide and streamlined interface coupled with real academic tools that could replace ones you're already using. Not bad for the price of free. http://lore.com/prasad.enagandula

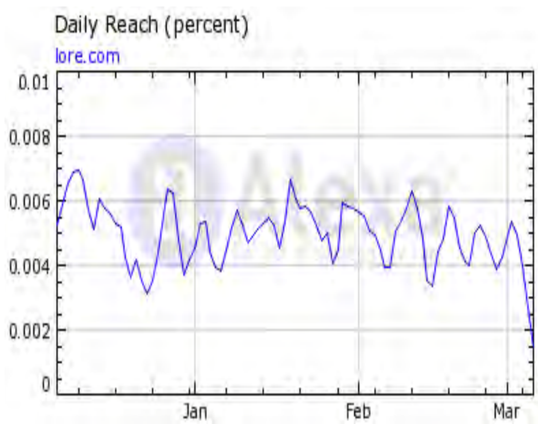

Figure 4.Lore daily visitors in percentage

Table 1.Country wise Lore Views

	United States	37.7
	India	11.1
	Jnited Kingdom	5.9
	Brazil	3.5
	Canada	3.2
	Australia	2.7
	Japan	2.6
	Ghana	2.5
	Turkey	2.1
	Spain	1.8

2.3 Twitter

According to Wikipedia, Twitter is an online social media source and networking service and micro blogging service that enables its users to send and read text-based messages of up to 140 characters, known as "tweets". With this we can compose and share a tweet. Which includes may be URL in which we that you have created notes for example if we type "Prasad enagandula" in twitter search engine we can get the following with URL Prasad enagandula @eprasadsai M1@education .In this way student can access the material notes they can give reply .

2.4 Wikipedia

Wikipedia is another most used widely social media tool which allows its users to add, modify, or delete its content via a web browser usually using a simplified markup language or a rich-text editor. Wiki is one mostly high used tool among students in study .It results the student requirement very fundamental and gives required related information its application where students needs with respective language. It explains the content in 114 languages. We also know and remind that women tend to be more active in social networks than men and social networks are growing rapidly in priority countries such as India and Brazil.

2.5 Blogs

It allows users to create their own blog with beautiful customized template at free of cost. Free weblog publishing tool from Google, for sharing text, photos and video. In our college we have created a blog namedpmat07.blogspot.in with the help of Google Docs or Drives and little bit of HTML knowledge. In this we share and publish notes on the website.So, every student can access the material and then can also leave the message. Start a class blog with simple announcements, homework, assignments, Tutorials, and external links**.** To differentiate, the advantage is that it allows easy filtering of content for various presentations: by date, category, author, or other attributes.

2.6 You Tube

According to Mashable, YouTube was founded in February 2005 and has become the go-to site for video on the web. One hour of video is uploaded to YouTube every second. Google bought YouTube in 2006 and underwent a significant redesign in 2011.With this we can share videos with friends, family and the world The Times of India says "over 800 million users visit YouTube every month, over three billion hours of videos are watched every month and over 72 hours of video content is uploaded every minute".

2.7 YouTube EDU

YouTube EDU is specific tool derived from You Tube. It provides user to learn, create, teach and share content without any cost. With the help of this we can theoretical concepts come alive. Tap our students' mind of the visual learner. In this we can also find short lessons from top teachers around the world, full courses from the world's leading universities, professional development material from fellow educators, and inspiring videos from global thought leaders.For example, the following table shows the number of videos uploaded on free open online web and video courses for science and engineering. The statistics might be increasing day by day .In our college we have AV (Audio/Video) classes every week for each section.

Table 2.Number of Videos Uploaded In YouTube EDU

Name of the video browser	Number of videos uploaded	Number of views
Nptelhrd	11,335	9,252,451
UCBerkeley	5,383	6,876,500
MIT	2,616	5,462,761
Stanford University	1,760	4,693,528

2.8 Khan Academy

Khan Academy is a non-profit organization with over 60,000 students worldwide and is a library of videos numbering over 1100. Students are able to leverage a wide range of topics in Mathematics, Statistics, Physics, Chemistry and Biology. Khan Academy videos work through a numerous sets of problems providing the most comprehensive set of teaching videos available. Khan Academy also has sample standardized tests for SATs and GMAT.

XimarcStudios Inc. is proud to bring us Khan Academy Statistics released on 08March 2010. Khan Academy Statistics allows students to learn Statistics through various videos which can be downloaded directly on our iPhone or iPod touch and in the future with Compatible with iPhone, iPod touch and iPad. It requires iOS 3.1.3 or later versions. Students can watch the video anywhere, anytime, all the time and NEVER be concerned about having access to the internet while you are going through a Khan Academy lesson.

Khan Academy Statistics From Tech Cocktail (Jan22,2013)

Figure 5.Khan Academy visitor and their areas of interest

2.9 Learners Tv

This is a comprehensive site providing thousands of downloadable Video lectures, Animations, study notes, Online Test, Presentation, Magazines, Live Online Tests in the fields of Biology, Physics, Chemistry, Mathematics, Computer Science, Engineering, Medicine, Management and Accounting, Dentistry, Nursing, Psychology, History, Language Training, Literature, Law, Economics, Philosophy, Astronomy, Political Science etc .This site provides free video and audio lectures of whole courses conducted by faculty from reputed universities around the world. It supports with Flash player 9.0.115 to view some of the videos. To view the videos full screen you need to have Flash Player 9 installed Science Animations provide students with fun and innovative ways of learning. Free live timed online tests with instant feedback and explanations will help you refine your test taking skills. Most of the materials offered are licensed by the respective institutes under a Creative Commons License. Video Lectures, Video Courses, Science Animations, Lecture Notes, Online Test, and Lecture Presentations. Saturday, March 09, 2013 Video, Lectures: 29352Live Animations: 410.India got the highest percentage of visitors followed by USA

Table 3.Country wise Learners TV Views

	India	23.5
	United States	8.4
	Russia	5.6
	France	4
	Pakistan	3.4
	Germany	3.2

2.10 iTunes U

Harvard University is the oldest institution of higher learning in the United States. Harvard University is devoted to excellence in teaching, learning. Harvard on iTunes U allows the University to distribute world-class educational content to the world at large. iTunes U is a part of the iTunes Store featuring free lectures, language lessons, audio books, and more, which you can enjoy on your iPod, iPhone, Mac or PC. Explore over 350,000 educational audio and video files from top universities, museums and public media organizations from around the world. We can add to your collection anytime, 24/7.

According to The Times of India Careers (Feb 28, 2013, 08.16PM IST) iTunes U courses with over 2, 50,000 students enrolled in them. Top universities like Duke, Yale, Cambridge, MIT and Oxford have enrolled more than 1, 00,000 students in single iTunes U courses. Stanford and The Open University have seen 60 million content downloads on the mobile.

According to the iTunes U (The Open University on iTunesU) and its impact as shown below, explains the geographical breakdown of downloads from 5 Feb-11 March 2013.

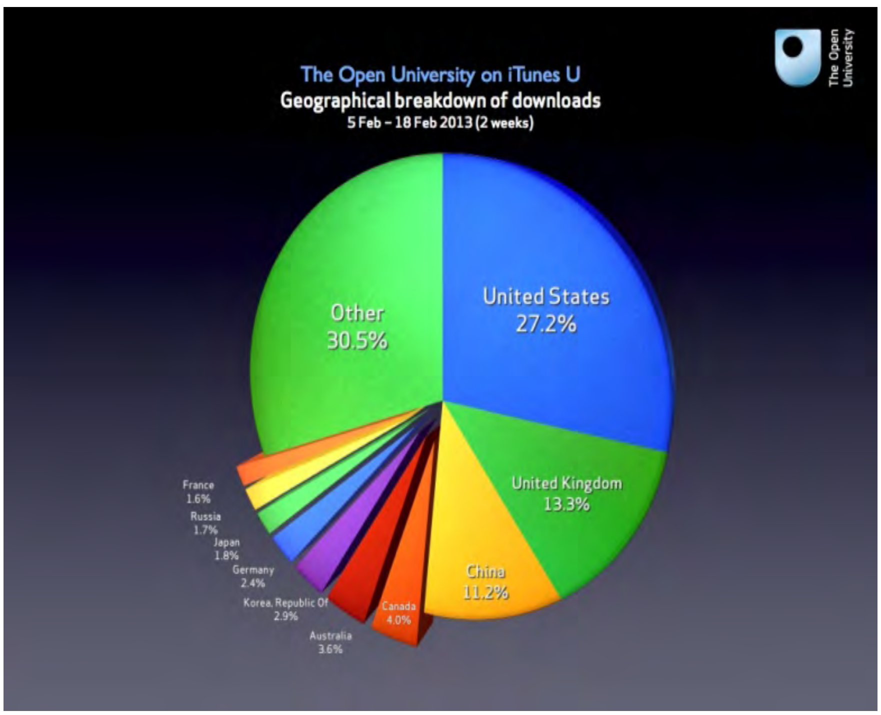

Figure 6.iTunes users in throughout the world

2.11Geogebra

GeoGebra is free dynamic mathematics software for all levels of education that joins geometry, algebra, graphing, and calculus. Most parts of Geogebra are free software and GeoGebra 4.2.21.0: Flexible and free mathematical software. India ties with geogebra report gives India Hits 255898, Files 207965, kBf 11437010, kB In 511, kB Out 0

Table 4.Geogebra monthly report
Table 5.Country wise Geogebra

Monthly Statistics for February 2013	
Total Hits	38056317
Total Files	28837814
Total Pages	7898439
Total Visits	1354108
Total kB Files	2503550059
Total kB In	26548
Total kB Out	0
Total Unique Sites	1250380
Total Unique URLs	62950
Total Unique Referrers	145096
Total Unique Usernames	34
T Total Unique User Agents	45375

Country	India
Hits	255898
	0.67%
Files	207965
	0.72%
kB f	11437010
	0.46%
kB In	511
	1.93%
kB out	0
	0.00%

3. Implementation and Results

As lecturers in an engineering college we personally feel working in collaboration environment, in order to prepare students, academia has to follow suit in its learning methods. In a world of digital information and continual information exchange, projects are now not only marked based on content, but group dynamics and teamwork. To facilitate this concept in education, tools including Google docs, Skype, social networks and wikis are implemented in our institution. we prepared a blog named pmat07.blogspot.in; in this blog we post students lecture notes, assignment, exam schedule with the help of Google docs and html code and keep monitoring their responses in class .in our institution we were implemented audio and video class with one hour /per week .with the help of YouTube EDU .We download corresponding lecture video and we play it. After a video we provide web link.

4. Discussion and Conclusion

The developing social media tools and open resources that we have discussed in this paper are existing free resources among students. We should take advantage of this resource to make learning more accessible. Students feel free and comfortable to use the tools that they already know. Using Social media we can have Communication, Public Relation**,** Intelligent adoption of social media tools can engage students in interactive learning, which is the key to a successful education**.**

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The MIT LINC 2013 Conference

Parallel Presentations

Session #9
Organizational Design Requirements for Successful E-Learning

- "Public Policy for the Use of Free and Open Source Software in Education at the University Level: The Case of Brazil" presented by Ana Cristina Azevedo Pontes de Carvalho
- "From Enthusiasm to Strategy: Four Critical Factors to Sustain the Development of Technology Enhanced Learning in Educational Organizations" presented by Hervé Didiot-Cook (England)
- "A Satellite EDUSAT: Changing the State of Education in India" presented by Nidhi Garg (India)
- "New Pedagogical Models Facilitated by Technology" presented by Eng. L. Liyanage (Sri Lanka)
- "E- University: Bridging the Equality and Opportunity in Education for All" presented by Wanida Sujjapunroj (Thailand)
- "A Design for Quality Improvement in Remote Higher Educational Institutions Using Technology and Knowledge Management—an Indian Experience" presented by U. Thiruvaazhi
- "Virtual Support Services for Educators (VSSE)" by John T. Okewole (Nigeria)

Public Policy for the Use of Free and Open Source Software in Education at the University Level: The Case of Brazil

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Abstract
This paper analyses the definition of free and open source software (FOSS) and discusses the public policies and measures adopted by the Brazilian Government in order to disseminate it in education at the university level. In Brazil, the right to education requires the adoption of public policies that stimulate the use of FOSS and promote digital inclusion. An important point is that the Brazilian Government recently adopted some measures to stimulate the use of FOSS, principally in public education. FOSS improves access to information, as it allows the teacher to provide selected content from the Internet for students, and it also functions as an instrument of social inclusion.

1. Introduction

Education can be analyzed as the process that creates the possibility of the production or construction of knowledge [1]. In this sense, education does not reduce itself to the mere transfer of knowledge. In a globalized and digitalized world, computers and their programs - software - cannot have their role reduced to the mere support of knowledge transfers. The digital world can and should create the possibility of the production and construction of knowledge itself. For this to occur, it is necessary to secure access to both computers and computer programs - free and open source software - to make possible the production and construction of knowledge through capacity building, awakening the curiosity of teachers and students, and the construction of networks of knowledge sharing. The role of the State is therefore fundamental in developing public policies that assure access to computers by means of open source software and that furthermore promote digital inclusion in a more amplified form.

The goal of this paper is to reflect upon Brazilian public policy for the diffusion of open source software in education, considering that technological progress should respond to human interests on a fundamental level. To do this, we will first define open source software and study its fundamental characteristics. We will then analyze the public policy of open source software and the role of the Brazilian State regarding both the use of open source software in education and the more general issue of the public policy of digital inclusion. Special attention will be given to the priority of use given to open source software and capacity building in open source software.

The focus of this paper does not reside in the repercussions of the use of free and open source software (FOSS) in the teaching of technology courses, whose importance has already been clearly demonstrated by the regular improvements made to source code and furthermore by the sharing of knowledge between researchers, professors, and students, in the form that the ideas of one can be reformulated and improved upon by others. The emphasis of this paper resides in reflecting upon the role of open source software in education at the university level - classroom teaching, online distance learning, and a mixture of the two - and in the strategies that the Brazilian Government has adopted to foment its use.

2. FOSS and its Fundamental Characteristics

In Brazil, Law n. 9.609/98 defines a computer program (software) as the expression of an organized set of instructions in natural language or code, contained in a device of any nature, of necessary use in automatic machines for handling information, devices, instruments, or peripheral equipment, based upon digital or analog technology, to make them work for determined ends. The first law in Brazil regarding software was Law n. 7.232/84 that deployed a National Computer Policy, establishing laws that specifically dealt with this material. Afterwards Law n. 7.646/87 established intellectual property protections for computer programs and their commercialization, being further regulated by Decree n. 96.036/88. With the arrival of the administration of President Collor, the application of this legislation was ended due to the liberalization of the Brazilian economy and was replaced in 1998 by Law n. 9.609/98 (the Software Law) and Law n. 9.610/98 regarding authors' rights [2].

Computer programs, also known as software, can be "free" or not. Therefore in opposition to proprietary software, whose source code is only known by the business that developed it, free software is based upon a philosophy shared knowledge, whose source code of can be freely accessed by its users, with the goal of modifying and improving the code. The rights to the code do not belong to an individual, because countless users contribute to its improvement. While Brazilian Law prohibits patenting software in itself, the National Institute of Industrial Property does allow patents when a piece of software has a technologically innovative effect, in other words when a piece of software is part of a process that creates a specific industrial effect. This distinction is nebulous. In reality, proprietary software receives a copyright like protection, although there are demands to treat software as a patentable invention or to create a sui generis form of protection specific to software [2].

There is a difference between free software and open source software. Open source software as defined by the Open Source Initiative requires: (1) free redistribution, (2) access to the source code, (3) permission to create derived works, (4) integrity of the author's source code, (5) no discrimination against persons or groups, (6) no discrimination against fields of endeavor, (7) free distribution of license, (8) license must not be specific to a product, (9) license must not restrict other software, (10) license must be technology neutral. Free software can be considered open source, but free software follows the ideals of the Free Software Foundation. In the other hand, the Open Source Initiative is more receptive to market related software initiatives.

In relation to the free and open source software model, one of the classic definitions is provided by the Free Software Foundation [3], which provides four essential requirements for free software:

(0) the freedom to run the program;
(1) the freedom to study and change the program in source code form;
(2) the freedom to redistribute exact copies; and
(3) the freedom to distribute modified versions

These definitions are the essential basis of free software, whose licenses never contain restrictions regarding the issues of use, copying, alterations, or distribution. It is important to be clear that free software is always associated with licenses that have express provisions regarding aspects of these general freedoms. It is an opportunity to exercise the curiosity for the program's use, study, possibilities of alterations, and the solidarity of distributing copies, giving everyone the opportunity to enjoy the changes made. The exercise of curiosity in a process of teaching, as Freire points out [1], summons the imagination, the intuition, the emotions, the conjectural capacity, and the ability to compare and contrast in the search of the outline of the object or in finding its reason of being.

While the free software model allows for the exercise of these four freedoms, proprietary software prevents the user from any possibility of using the ideas contained in the software's source code, which limits the possibilities of learning, improvement, and adaptation. Overall, the proprietary software model forces the user into a state of dependency upon the software provider, due to the difficulties created by the lack of interoperability between different platforms [2].

It is important to consider the term "free" in regard to free software. There is a strong tendency to associate the word "free" with the economic sense of the word, as in without cost. The correct term for this type of software is freeware. The term "free" when applied to software is more associated with the concept of liberty. The expression Free and Open Source Software is based upon a philosophy that opposes the privatization of knowledge and foments solidarity and cooperation in a community endeavor that develops a network of creation based upon open source norms.

Generally free software is without cost and therefore benefits the whole population, including those who lack the means to consume. If technology has an enormous potential to stimulate and challenge humanity, especially the most favored classes [1], free software can be used as an important tool for teaching and digital inclusion, aiding in the breaking down of barriers that prevent less privileged classes from equally benefiting from technology.

It is important to highlight that the FOSS movement, understood as a movement based upon the principles of knowledge sharing and solidarity practiced by the collective intelligence connected in the global computer network [4], looks to capture the energy of new users to share knowledge and innovate, which can be very useful for developing nations.

3. Public Policy, FOSS and the Role of the Brazilian State

The use of free software in education, particularly in schools, can aid in the digital inclusion of citizens, especially when such programs are without cost, resulting in lower expenditures for the government. The utilization of computers and software cannot be restricted to the parts of society that have the economic means to purchase them, and the government cannot become hostage to a technology by paying licenses for use that can prevent to goal of digital inclusion. Therefore public policies that promote the large scale use of FOSS are necessary and aid to disseminate the freedoms that are the essence of open source computer programs.

In this sense, it is necessary to understand the significance of public policies the Brazilian State in the promotion of FOSS. Garcia [5] considers pubic policies as principles, the collective goals that direct the activities of the State in the furtherance of the public interest. Here is the foundation of state action in fomenting the use of FOSS, especially in education, allowing all citizens access to computer programs and the ability to equally contribute in the development of such programs, aiding in the sharing of knowledge.

In relation to the juridical nature of public policies, it is important to highlight that Bucci [6] analyzed this question, determining if policies consisted in activities, programs, coordinated actions, processes, or norms. The author defines public policy as a program of government action that results in a process or a set of processes regulated by law (such as electoral processes, planning processes, government processes, budgetary processes, legislative processes, administrative processes, and judicial processes) to coordinate the means of the State and the private sector toward the achievement of politically determined socially relevant objectives. Ideally, public policy should aim at achieving a defined set of objectives, expressing a weighted selection of priorities, within the budget necessary for success and the time allotted for the goals to be achieved. Analyzing a working hypothesis defining public policy as a norm, Bucci [6] understands that laws are characterized by their general and abstract nature, while politics is neither general nor abstract, but aims for the achievement of specific goals. Under this argument, the author denies that public policies are a category defined and instituted by the law, but are complex arrangements typical of political and administrative activity, and that legal science should be eager to describe, understand, and analyze them, with the goal of integrating political activity with the methods and values of the judicial universe. In reality, public policy can be a way to promote the effective insertion of FOSS in teaching, accomplishing the goal of digital inclusion.

3.1 Teaching and the Use of FOSS

To ensure a better future for long distance learning, Armengol [7] has argued that Latin American societies should reform their educational systems making them more responsive to social, scientific, and technical needs, while at the same time preventing schools from reinforcing current inequalities in status and wealth. It cannot be forgotten that decades ago, distance learning was done primarily by correspondence or using traditional means of communication. Paine [8] cites diverse examples, including a Scottish case study - the “Campus Radio”, a series of programs entirely compiled by educational institutions and members of the teaching profession which provided traditional night school courses at no cost over the radio. Over the last decades distance learning has expanded due to technological advances, taking advantage not only of personal computers and the internet, but also cellular phones, notebooks, and smartphones.

FOSS is not only used intensively for distance learning, but can equally be observed in traditional live instruction and mixed live online teaching by the availability of complementary material within a determined platform and the existence of computerized libraries and computer labs. FOSS can also be an important tool in the teaching of computer science, because it is possible to both study the software and to modify it.

The analysis of the source code of FOSS by computer science students allows them to identify the goods points, certainly resultant of alterations made by other programmers, and also points that still can be improved, allowing the students to consider what would be the best option to refine the logical construction and to further develop the code. Innovation shows itself here as sequential and complementary.

In both computer science and other university courses, using either distance or live instruction, FOSS can increase students' access to information. With the internet, the amount of information available is vast, but the role of the teacher in selecting appropriate information and allowing the student to advance in a rapid and effective manner is of great importance. As a matter of fact, Silva [9] points to the existence of a vast doctrine recognizing the importance of information as a fundamental element for the development of critical thinking, the exercise of citizenship, and the development of the nation, and Freitas and Efing [10] recognize the undeniable importance of the use of new technologies (including the internet) in the daily life of citizens, acting as true instruments of social inclusion and contributing to the development of the rule of law.

3.2 Public Policy for Digital Inclusion: The Priority of FOSS Solutions and FOSS Training

The adequate development of the public policy for digital inclusion requires, with the agreement of Suaiden [11], the creation of a thorough diagnosis regarding the informational needs, with the use of decision making techniques, to elaborate a strategic plan compatible with the social reality. Beyond this, it is fundamental to understand that digital inclusion cannot be reduced to merely the buying of computers and the teaching the use of certain software programs. The technological infrastructure represents only one of the elements that produces digital inclusion or exclusion. In reality, a computer literacy should be provided that enables citizens to identify the need for information, to organize and apply it in practice, and to integrate it into a pre-existing knowledge base allowing for the solution of problems [12].

Carrying out a preliminary inventory of Brazilian public policy regarding digital inclusion, it is possible to highlight the following initiatives produced by the Federal Government: Broadband Program for Schools, Home Brazil, Computers for Inclusion, Workshop for Digital Inclusion, Observatory for Digital Inclusion, Connected Citizen Project – A Computer for All, The Electronic Government Citizen Service, Program for the Implantation of Multifunctional Resources Rooms, Computer Project for Social and

Digital Inclusion, National Program for Continued Formation in Educational Technology (Integrated ProInfo), Communitarian Telecenters Program, Telecenters.BR, Digital Territories and A Computer for Every Student [13]. The State Government of Sao Paulo has implemented the Access for Sao Paulo Program for Digital Inclusion [14], while the City of Sao Paulo is executing its City of Sao Paulo Digital Inclusion Plan [15]. This list shows the quantitative level of government programs.

Digital inclusion, however, will not be able to be accomplished if it is not accompanied by policies that promote the increased use of FOSS that can both contribute in terms of infrastructure and in respect to digital literacy. This is because the sharing of software and other products of collective intelligence is decisive for the democratization of the benefits of technology and needs to be incentivized [4]. It can be observed none the less that the Brazilian government has chosen to prioritize FOSS solutions.

This way, Decree n. 7.243, of July 26, 2010, created the Student's Computer Program (PROUCA) and the Special Regime for the Acquisition of Computers for Educational Use (RECOMPE). Article 2 § 3 of this Decree establishes that for the RECOMPE program, free open source software without license costs will be given priority, conforming with directives of the education policies of the Education Ministry.

RECOMPE allows for tax exemptions for businesses winning bids to provide computers to public schools and to non-profit schools for the disabled. The taxes exempted are the Industrial Products Tax (IPI), the Contribution for Intervention in the Economic Domain and contributions to the Social Security system (PIS/PASEP and COFINS).

In the other hand, on October 5th 2010, Decree n. 7.325 promulgated the Memorandum of Understanding between the United Nations Conference on Trade and Development and the Government of Brazil for training in free open source software for developing nations, which was signed in Tunis, on the 16th of November, 2005.

Among other forms of expected cooperation stated in the memorandum, the highlights are:

- Training individuals with the skills necessary for using, customizing, and developing FOSS applications;

- Establishing new and strengthening existing mechanisms for collaboration in the distribution and development of software;

- Improving both national and international policies regarding FOSS;

- Concentrating efforts to aid local training initiatives, which do not require, but can greatly benefit from partnerships;

- Promoting digital inclusion by developing initiatives creating telecenters based upon FOSS, especially in Africa, Latina America, the Caribbean, and the Community of Portuguese Language Countries;

- Providing training in communities and universities interested in FOSS solutions;

- Providing technical and organizational training to promote the use and development of FOSS in government administration and online government initiatives;

- Concentrating resources to spread FOSS, creating distance learning and knowledge sharing platforms;

The utilization of FOSS by the public sector has been increasing in recent years and is essential to guarantee that public school students will have access to the benefits of instruction with FOSS. In reality, as Silveira maintains [4], digital inclusion is a first step for socially excluded populations to appropriate technology for the end of breaking the cycle of poverty. In this sense, FOSS favors the spread of information that is one of fundamental pillars of education.

4. Conclusions

The benefits gained for utilizing FOSS in education at university level, especially in technology classes, are indubitable, as it allows students to analyze and improve a source code which is open to the whole community. The use of free software can also benefit live format and distance learning in all university courses, especially by the use of no cost platforms, which increase the level of access available. It can be highlighted that the availability of complementary materials in FOSS platforms, working both in live instruction and part online instruction, revolutionizes teaching methodologies, by giving students access to a diverse range of resources, which include internet articles and games that allow for practice and testing of concepts learned.

The table below shows Brazilian public policy for digital inclusion, analyzing whether they focus on education and FOSS:

Policy’s name	Focus on education	Focus on FOSS
Broadband Program for Schools	Yes	No
Home Brazil	No	Yes
Computers for Inclusion	No	No
Workshop for Digital Inclusion	No	Yes
Observatory for Digital Inclusion	No	No
Connected Citizen Project – A Computer for All	No	Yes
The Electronic Government Citizen Service	No	Yes
Program for the Implantation of Multifunctional Resources Rooms	Yes	No
Computer Project for Social and Digital Inclusion	No	No
National Program for Continuing Education in Technology (Integrated ProInfo)	Yes	No
Communitarian Telecenters Program	No	No
Telecenters.BR	No	No

Digital Territories	No	No
A Computer for Every Student	Yes	No
Access for Sao Paulo Program for Digital Inclusion	Yes	Yes
City of Sao Paulo Digital Inclusion Plan	Yes	Yes
Decree n. 7.243	Yes	Yes
Decree n. 7.325	Yes	Yes

Table 1. Analysis of Digital Inclusion Public Policy

This way, the means adopted by the Federal Government, and also by Sao Paulo State and City Governments, in order to foment the use of FOSS, are fundamental for the dissemination of these computer programs and demonstrate the government's desire to intensify the use of FOSS in public schools and universities.

FOSS promotes the full realization of democratic goals, by means of sharing source codes, permitting effective interaction between a program and its user, and aids in the democratization of the gains from technology. Because of this, education policy should strive to spread its use.

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From Enthusiasm to Strategy: Four Critical Factors to Sustain the Development of Technology Enhanced Learning in Educational Organizations

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Abstract

At a time when Massive Open Online Courses (MOOCs) are making headlines in the education world, I will explore in this paper which factors are essential to sustain the integration and the development of E-learning or Technology Enhanced Learning in educational organizations. After providing an extensive definition of E-learning and arguing why an E-learning strategy is required, I will look at two analytical frameworks to comprehend the challenges faced. The first analytical framework, the Actor Network Theory (ANT) enables us to understand that IT, ICT and E-learning are about complexity, interaction, agency and power. The second analytical framework by Andreu and Ciborra (1996) will give us at the practical level of each organization, a template on which successful implementation of E-learning may be designed. Finally, based on my experience and two examples, four critical factors will be singled out: 1) Collaborative working practices, 2) Leadership, 3) User friendly technology and 4) Support.

1. Introduction

Massive Open Online Courses (MOOCs) are an "attack on education business" claims French Sociologist Dominique Boullier (2012). They are only part of "an avalanche […] and the revolution ahead" reply Barber, Donnelly and Rizvi (2013) from the multimedia company Pearson. Their British employer, one of the largest book publishers in the world has turned itself into a serious contender in online learning solutions when it purchased last October for $650m EmbanetCompass, a leading US provider (Pearson, 2013). British universities are preparing their counter attack for Autumn 2013. They created Futurelearn (2013) which was launched last December. Eighteen of them including the universities of Southampton and Warwick have joined forces with the British Library and the Open University, the leader in distance education in the UK. The almighty Coursera (2013) with to date, 62 universities across the world, has been joined only by a handful of European higher education institutions including two British ones, the Universities of London and Edinburgh.

I entirely agree with Dominique Boullier (2012) when he emphatically wrote last December: "The massive commercial war on education is now launched and everyone is supposed to adopt a strategy to counter it". Based on my personal experience and two examples that I will detail in this paper, I will argue that Technology Enhanced Education or commonly referred as E-learning here, must be underpinned first of all, by an explicit and defined teaching and learning approach shared across the organization. In my opinion, the lack of an explicit pedagogy is the first and most single impediment to the development of E-learning. Thanks to Zupan (2009) I will then explain why an E-learning strategy is required. Two analytical frameworks, very different from one another, will be explored. The Actor Network Theory will help us to understand the effects of specific IT artefacts such as PCs, software and the "power" of technology, in which I will include E-learning. Through Andreu and Ciborra's analysis of the role of IT in firms (1996), I will suggest how their contribution can be understood by educational institutions to establish core capabilities in E-learning. Finally I will single out the four critical factors necessary to ensure that e-learning is embraced and implemented by an educational organization as a whole, inclusive of all its members, teachers, students, support staff and parents alike.

2. An extensive definition of E-learning

Although MOOCs are not yet fully fledged distance learning courses, they already play an innovative role, albeit limited at the moment, in the education landscape as hundreds of students are very appreciative of their existence. MOOCs are only the latest development in terms of online educational resources. Let's not forget the huge success of iTunesU and YouTube, the smart elegance of Mendeley and Prezi, the simplicity of Showbeyond.com and the reliability of ScreenR, free and almost unlimited storage on Dropbox to mention just a few. We should also cite the many foundations, museums and media, such as the BBC Bitesize for K-12 sector or The Economist, purveyors of outstanding content as well as the hundreds, the thousands of individuals, who create for no financial gain, unique pedagogical resources to help children and parents struggling with school homework.

With so much content, so many tools, software and applications available to students and instructors alike, where can all this possibly fit into the digital landscape of education ? From a faculty or a teacher's point of view, students spend far too much time texting or playing games from their smartphones, chatting on Facebook during lectures and, all too often, submitting their essays at the last minute cutting and pasting the most poorly edited Wikipedia entries. Is it because of their youth and subsequent lack of maturity or does it say something about our teaching?

For the purpose of this paper, I am defining E-learning in the widest possible sense to include both online distance learning and blended learning, Technology Enhanced Education and Technology Enhanced Learning. That is, any online resources such as E-books, websites… online interactive activities like quizzes, wikis, blogs…which can be integrated into the syllabus, and can be undertaken inside and outside the classroom. With the exception of the occasional examination setting where students may still write with a pen, academic communication skills are fast becoming totally mediated by a PC or a laptop/ tablet as well as the World Wide Web which offers the wealth of sources and resources we mentioned earlier. British universities have also been concerned for a while with their students' academic communication skills. Secker, Coonan, Webster et al (2013) are promoting ANCIL – A New Curriculum for Information Literacy. Coonan and Secker (2011) show in their mapping of the Information Literacy Landscape how "academic literacies", "information literacy" "media literacy", "new literacies" and "digital literacy" are overlapping one another. For example, academic writing is part of academic literacies as well as information literacy as students are required to reference their researched essay based on academically published evidence. The search skills acquired by students are part of both information literacy and digital literacy because they exclusively use online search engines etc… Therefore, I also include all the literacies mentioned above by Secker and Coonan (2012) in our extensive definition of E-learning because they are mediated by Information and Communication Technologies (ICT).

3. Learning as Doing versus Teaching as T elling

Before establishing an E-learning strategy, an educational organization needs to assess which pedagogical approach or teaching and learning approach its courses and teaching are based on. The lack of consensus regarding the adoption of an overarching theory in teaching and learning will impact deeply not only on the type of online resources and activities that will be developed, but also their success amongst students. The focus on online resources as opposed to activities may show that the learning process is centered on the primacy of teaching as opposed to the needs and engagement of the learner.

All too often so called "E-learning" is reduced to a set of online recorded lectures complemented by quizzes or multiple choice questionnaires. These do help and support students in many ways, but they are falling short of our expectations. By reducing E-learning to the above, we are failing to grasp a fundamental premise: learning is an essentially active process. Whilst recording lectures, many universities still expect hundreds, yes hundreds of students to physically sit through them, assuming on one hand that all academics can be a Socratic performer in front of 300 students, whilst deploring that the same students in the same lecture hall will be checking their Facebook account on their laptop or tablet. But then again, in the same way some Wikipedia entries are of outstanding quality, Facebook is also used by students to support their peers in their studies. Educational organizations must acknowledge that students also use social networking tools to exchange knowledge and practice exam questions. Universities are also to be reminded that learning is indeed a social activity. Fortunately, as I will show later, some schools and universities are grasping the opportunities offered by other social networking tool such as Elgg, E-portfolio software like Mahara or PebblePad, to develop pedagogical activities centered on the learner (Tandem learning in foreign languages, reflective learning in accredited work placements etc…).

In my opinion, too few educational institutions seem to be aware that a paradigm change has occurred in education (Laurillard, 2002). A radical shift has taken place from "teaching as telling" (tell-practice-test) to "learning as doing" with the learner defined as an active agent. A plethora of pedagogical models such as problem-based learning, situated learning, meta-cognition, social constructivism, collaborative learning… have been developed over the last fifty years to reflect this fundamental change. All are defining learning as an essentially active process. This is no accident that Australian IT specialist Martin Dougiamas (1998) found Constructivism to be the most appropriate learning theory on which to underpin its E-learning platform. This was to become Moodle, one of the most popular open source VLE to date in both Britain and France.

4. The need for an E-learning strategy

Educational organizations in Britain often appear to rely on a few dedicated and enthusiastic teaching or academic staff to introduce and sustain e-learning. Supported by IT specialist staff and by instructional technologists in large universities, these enthusiastic teachers or academics sometimes called E-learning Champions (BECTA, 2005) or E-learning Co-ordinators (University of Kent, 2007) work tirelessly selecting and testing new software with their students, devising interactive activities, disseminating best practice, training and supporting time poor colleagues overwhelmed either by the latest changes introduced by the British Government in the K 12 sector or if they are academics, these will under pressure to demonstrate the “impact” of their research work to maximise future government funding. The appointment of E-learning champions might well be the most appropriate way to introduce ICTs at an early stage in schools and universities. However, the scope of this approach is very limited, should the organization for example, as a whole, aim to fulfil the needs of all its staff and students alike; thoroughly review its investment in hardware and software or equally; design a teaching and learning framework for a safer and more ethical use of ICTs including social networking and file sharing. I argue with Zupan (2009), that every educational organization should design as well as review regularly its e-learning strategy in the light of its pedagogical model and the changing needs of its students and teaching staff.

Zupan (2009) points out that schools and universities need to design an E-learning strategy for the following reasons. First, in designing such a strategy, they have to clarify the purpose of technology (Laurillard, 2002) and define their pedagogical model accordingly. Is the organization’s teaching and learning approach centered on the needs of the learner or on the primacy of teaching and lecturing? This is an important step as this will determine how ICT will be directed and managed. Second, institutions must establish at which stage technology enhanced learning is. Some institutions will be surprised to find out how little confidence their teaching staff have with technology, when in fact they are much more knowledgeable than they think. Institutions might also discover that their students’ IT skills are not as sophisticated as Prensky (2001) and many others first thought. Then, in the next stage advised by Zupan (2009) the success factors that will enable change will have to be established. McPherson & Nunez (2004) mapped out a multitude of factors affecting the implementation of E-learning (Fig. 1). I will single out, later on, four critical success factors. Finally, as Zupan (2009) concludes, an E-learning strategy will help institutions to align the interests of its stakeholders (faculty, students, administration, and so on) and establish an ongoing evaluation.

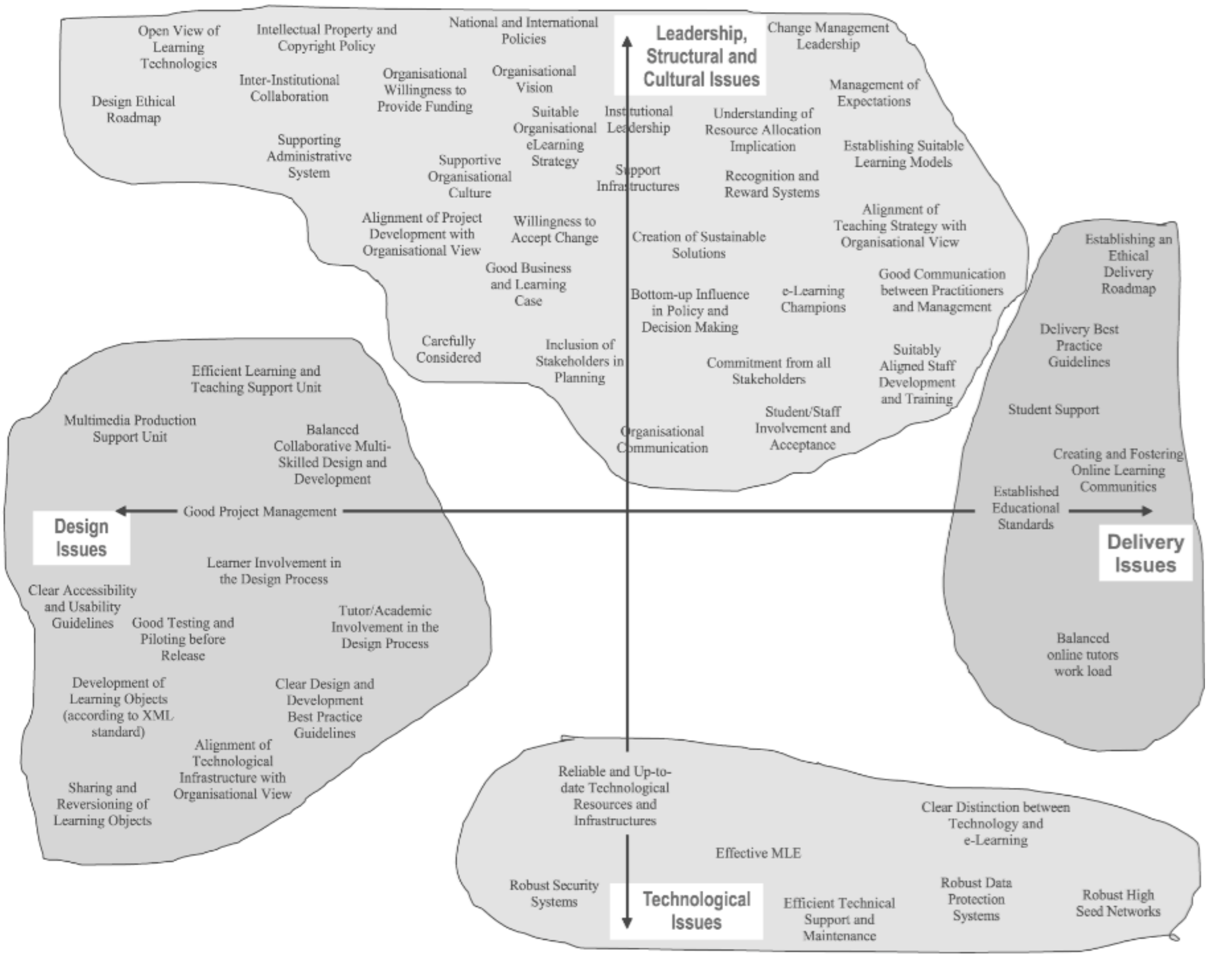

Fig. 1. McPherson & Nunez (2004) Mapping Success Factors in E-learning

Even when e-learning is underpinned by a sound teaching and learning approach, how is it that e-learning can be so time consuming and complex to implement? Why do some projects or initiatives appear to encounter many obstacles often small, yet significant enough to grind the project to a halt, causing major delays and a huge amount of frustration? On the other hand, many of us are puzzled when an small institution faculty, or a single individual, all with modest resources appear to be ahead of the game and deliver the most original, engaging, innovative E-learning ? Why do some fail when others succeed?

Two analytical frameworks will help us to understand the challenges faced. The first one, the Actor Network Theory (ANT) helps us to understand that IT, ICT and E-learning are much more than just about technology and pedagogy. They are about complexity, interaction, agency and power. Then, the second analytical framework by Andreu and Ciborra (1996) will give us at the practical level of each organization, a template on which successful implementation of E-learning may be designed.

5. Actor Network Theory

Actor Network Theory (ANT) was developed in the 1980's by French and British scholars in Science and Technologies Studies (STS). From an analytical point of view as a theory of the "social", ANT helps us for example to appreciate how science progresses and scientists work (Callon, 1986; Latour and Woolgar, 1979), to understand the collapse of the Soviet Union (Law, 1992), or to comprehend the multi-layered connections between reality and the so called emerging virtual worlds (Woolgar, 2002). The first radical assertion ANT is making is the following: we must not separate, when analyzing the "social", people from objects; we must not differentiate human beings from the "stuff" they surround themselves with, from the relationships, as well as the most basic connections with objects, people are immersed in. ANT argues that human beings define themselves, and exclusively so, by the social situation they are in, by the social interactions they necessarily generate.

According to ANT, outside the "social", people are nothing. Law (1992) asserts "*people are who they are because they are a patterned network of heterogeneous materials".* By materials ANT means literally everything: "*people, machines, animals, texts, money, architectures… any material you care to mention".* At the core of the "social" which "*is nothing more than patterned networks of heterogeneous materials"*, lie interactions, all sorts and type of interactions between heterogeneous materials, which in turn as "Actor Network" have agency, that is the "capacity, the condition, or state of acting or of exerting power" (Merriam-Webster, 2013). However, Law (1992) specifies that ANT defines power "*as a (concealed or misrepresented) effect, rather than power as a set of causes".*

E-learning under the guises of a MOOC or a VLE is an Actor Network, a complex web of connections and interactions. These may include human beings such as students, teaching assistants, the professor lecturing, the instructional designers, as well as objects such as campus PCs and students' laptops, videos, course text resources, quizzes, a combination of open source and proprietary software, email accounts and often Facebook… Most of the time, all it takes is the simple click of the mouse, once the username and password have been entered. This is because ANT says, complexity has "punctualised", compressed to an ultimate degree of accessibility and apparent simplicity. "*Punctualised resources offer a way of drawing quickly on the networks of the social without having to deal with endless complexity"* (Law 1992).

When we first integrated Wimba voice recording boards (Roger, 2006) onto our VLE (Moodle – The London School of Economics-LSE), we logically wanted to use expensive USB headsets to produce recordings of the highest quality. Unfortunately these USB sets whatever the brand used proved to be most troublesome and unreliable. Sometimes they would work perfectly, sometimes they would not. We realized that the issue was not due to the brand of headsets, or the type of PCs but simply the PC's USB ports. These were used so often by students' USB memory sticks, they were unable to read systemically USB headsets. A chat with a member of staff at the local electronic store solved our conundrum: the basic and cheapest 2 jack headset would always work and in fact, produce voice recording of the highest quality (Lingard, 2008). Thanks to this, from then on, LSE students were able to practice and develop their speaking skills in foreign languages because Moodle (and subsequently Wimba voiceboards) became at LSE "*a relatively stable network […] one* *embodied in and performed by a range of durable materials*" (Law, 1992). The same might be argued one day about MOOCs.

6. The role of E-learning in organisational learning and core capabilities development

In their analysis of the role of IT in organizations through the resource-based view of the firm (RBVF), Andreu and Ciborra (1996) provide a useful analytical framework to any educational organizations whose strategically aims make E-learning a core capability. Andreu and Ciborra (1996) demonstrate how IT participates in the organizational process that transforms resources into capabilities and eventually into core capacities. As they put it, RBVF "*focuses on the firm's resources and capabilities to understand business strategy and provides direction to strategy formulation*". In Figure 3, they divide the organizational context in three different levels: Resources, Capabilities and Core Capabilities. Amit and Schoemaker (1993 cited in Andreu and Ciborra, 1996 p.112) point out that:

"*Capabilities* refer to a firm's capacity to deploy *Resources*, usually in combination, using organizational processes, to effect a desired end […] Unlike *Resources*, *Capabilities* are based on developing, carrying and exchanging information through the firm's human capital".

For Andreu and Ciborra (1996), three essential loops transform and translate Resources (ie World leading professors, IT software…) into Core Capabilities (ie MOOCs). The first loop, the Routinization Loop is enacted by Working Practices. The second loop, the Capability Loop is controlled by Management Actions. The third and last loop, the Strategic Loop ensures that Core Capabilities are in line with the Organization's values and mission.

I argue here that E-learning can play the same participative role in educational organizations as IT does in firms according to Andreu and Ciborra (1996). As IT artifacts like spreadsheets or word processing, IT systems such as Document, Project or Customer Relations Management are used on a daily basis by administrative staff in educational organizations, E-learning is also integrated to one degree or another in the daily teaching and learning activities of brick and mortar schools and universities. As a consequence, E-learning is being transformed from a resource (any online resources) into a capability (VLE organizing resources coupled with activities) which in turn can become a core capability and the source of competitive advantages for an educational organization. In my opinion, this explains why and how MIT, Harvard and many other US universities are developing MOOCS.

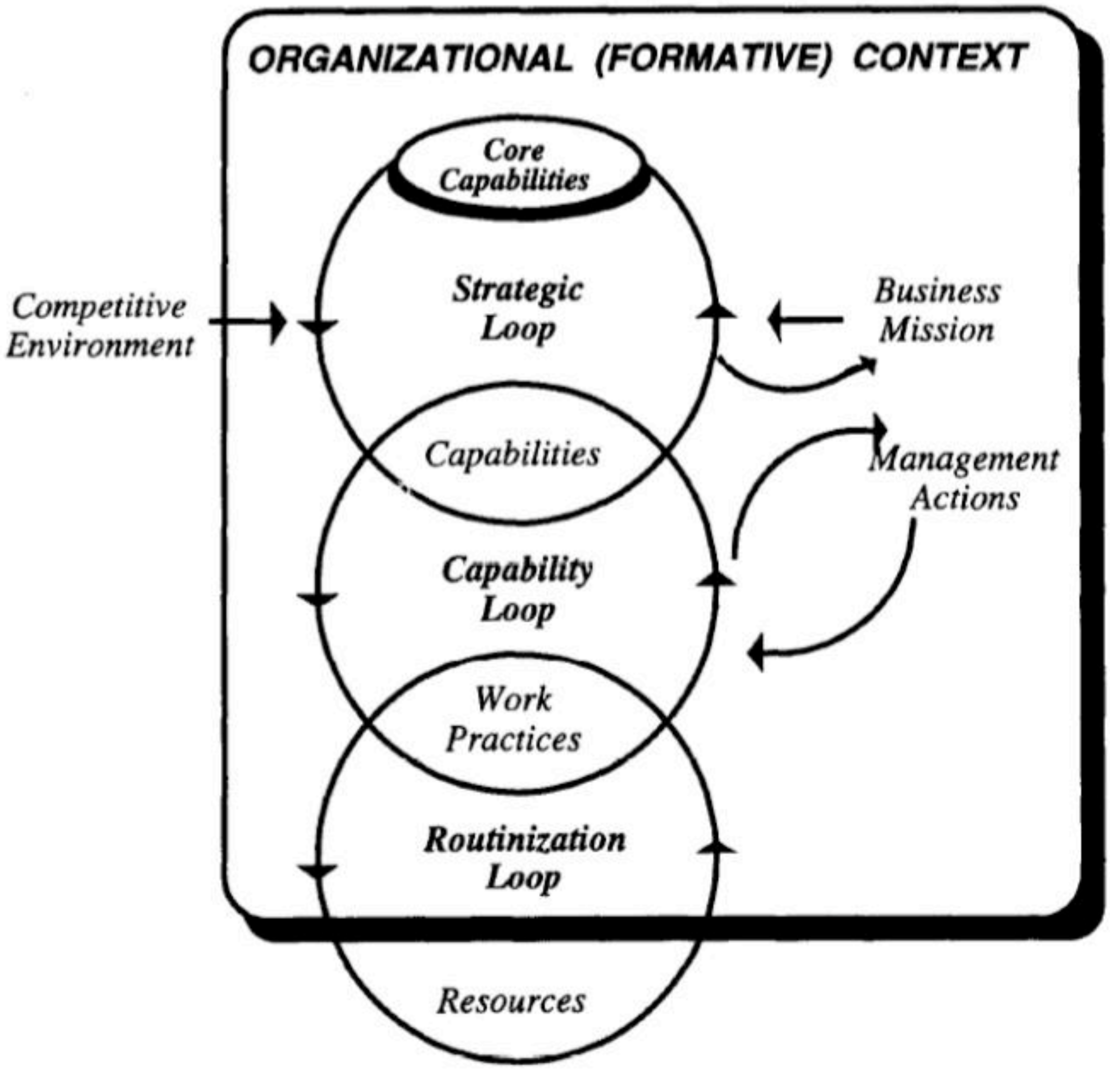

Fig. 2. Andreu and Ciborra (1996) Basic learning processes in the core capabilities formation process

The two following examples will show how E-learning can be successfully developed thanks to Andreu and Ciborra (1996). The first example will be about Paris Descartes a large university based in the French capital and specializing in Health, Bio and Medical Sciences, Mathematics, IT, Law and Social Sciences. The second example will focus on a small faculty teaching Modern Languages and English to degree level at the London School of Economics, UK. Paris Descartes has made e-learning a core capability. The French university has succeeded on many fronts when its neighbours are still struggling with the development of online resources and activities. Paris Descartes has set up a "Médiathèque", an online repository to archive media artifacts making them accessible to its students and staff. It has also been using Moodle extensively as a VLE in medical studies, one of its most demanding and challenging undergraduate courses in France as the number of eligible students is strictly limited. Students are keeping the faculty on their toes ensuring that resources are regularly up to date on the VLE. Paris Descartes has also innovated by using open source ELLG to establish a portfolio system "les Carnets 2", which has turned out to be more popular as a social network. Out of 34.000 students over several sites across the capital, over 14.000 are registered users utilizing the “Carnets” to create revision and study groups, advertise flat sharing vacancies and share cooking recipes. “Les Carnets 2” provide staff and students with a relatively safe digital identity, bound and regulated by the country’s stringent data protection and privacy laws. Paris Descartes has integrated the learning dimension in organizing on a yearly basis a conference on E-learning “la Journée Numérique” (JUM13) where staff showcase their innovative practice and share their experience with academics from other universities as well as members of the public. Internally Paris Descartes holds regular staff training and “show and share” sessions across the different faculties.

At the level of a small faculty, staff at LSE Language Centre have demonstrated how a learning activity, digital storytelling can be initiated in one subject (French) and then be implemented in other languages, as well as in other educational organizations such as schools (Watts and Forder, 2012). In terms of Core Capabilities, the Language Centre has to ensure that LSE students develop their ability in communicating in a foreign language at degree level (UK UG level 6). This requires the combination of language skills (Speaking, Listening, Reading, Writing) and subject knowledge (Economy, Politics…) through a set of pedagogical activities which are, as much as possible, engaging and personalized, underpinned by “learning as doing”. Digital Storytelling was first introduced to the author, LSE member of staff at the time, by Dr Stéphane Charitos from Columbia University during a training session at Columbia University Global Center in Paris. As *Resources*, the Center for Digital Storytelling in Berkeley, California (2013) provides all the know-how required for storytelling. This was then adapted by LSE teachers for the specific purposes of foreign language learning. Integrating standard tasks in foreign language learning such as describing and commenting on meaningful pictures, with the purpose to then, document, create and record a personal story narrated by the student in the foreign language. This proved to be a very successful activity.

Last but not least, the Teaching and Learning Facilitators from the LSE Language Centre and the Learning Technologists from LSE Centre for Learning Technology played a key role in both the Routinization Loop and the Capability Loop to support the teaching staff across the different languages taught. In the Capability Loop, they provide valuable advice and support in order to make sure that there are no technological or IT obstacles for students to undertake this activity.

7. Conclusion : Four critical factors to sustain E-learning

ANT as well as Andreu and Ciborra (1996) provided earlier in this paper, two complex analytical frameworks. ANT helps to understand the effects of IT artifacts and systems in organizations and society at large. Andreu and Ciborra’s focus on the role of IT in core capabilities development in organizations and MacPherson and Nunez map out the numerous success factors playing a part in E-learning implementation. Based on my experience and the two examples described above, I have singled out the following four critical factors ensuring the integration and the sustainable development of E-learning in educational organizations (Fig. 3): a) Collaborative working practices, b) Leadership, c) User friendly technology, d) Support.

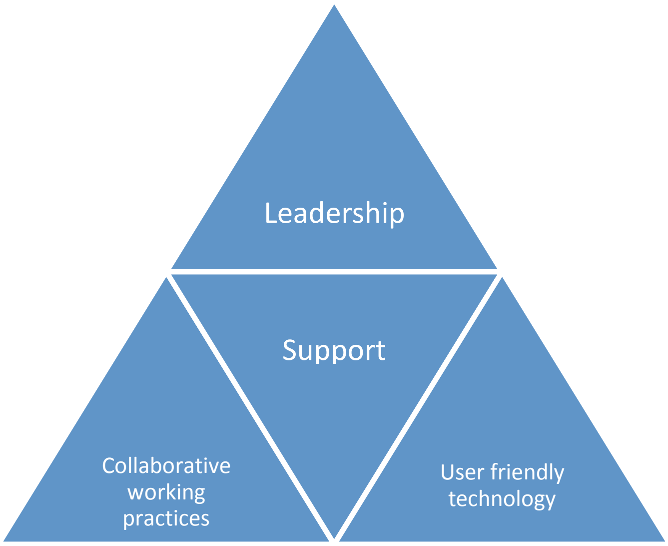

Fig. 3. Four critical factors sustaining E-learning

a) Working practices *must be* collaborative as technology implementation is complex and time consuming. Collaboration is a real challenge for a profession and system as a whole where teachers and academics don't work in a team based office environment. When in schools teachers spend the majority of their time, on their own in front of their class. Outside school time, they spend a lot of time preparing their teaching and assessing their students' work, again on their own. In universities, academics especially in Arts, Humanities and Social Sciences mostly work individually to carry out their teaching and produce their research. Teachers and academics tend to be solitary professionals. The disruption caused by technology and its inherent complexity, as well as a fast changing environment, require them to work with their colleagues, as part of a team.

b) The organization's leadership takes responsibility not just by defining the strategic aims of E-learning, it has also to ensure that adequate staff and resources are available for the implementation of the E-learning strategy. The Senior Management Team must lead by example and implement collaborative working practices themselves. They need to consult widely their staff to make sure their vision and actions are shared by the institution as a whole. Vision and strategies are not diktats imposed from above.

c) Technology must be user friendly to the school or the university adopting and developing E-learning (Koulopoulos, 2008). Which VLE or E-learning solutions will be considered user friendly will emerge through piloting and testing, along with incremental development? The Senior Management Team may let the teaching faculty decide what they want to use, offer them different options, trust them and support them. Teachers and lecturers ought to let students to figure out as much as possible what they feel comfortable to use. PowerPoint or Prezi, Showbeyond or iMovie, it should be up to students to choose. As a teacher, I shall assess a student's presentation or story for the quality of its content, as long as my attention is not impeded by too much gadgetry.

d) Finally, support is essential. It is at the core of successful delivery. Support is reciprocal and occurs across the institution's organizational or functional boundaries between different services like the library, IT services, registry, learning technology support… and faculties. Training is funded by the organization and "show and share" sessions may take place regularly. A school or university is by essence a learning organization, it seems peculiar that many teaching staff have stopped wanting to learn, learn from their own colleagues, learn from the latest developments in teaching and learning. It is the responsibility of leadership that all members of staff are given opportunities to work together and develop themselves as professionals to ensure that they are able support and deliver the mission of the organization.

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A Satellite EDUSAT: Changing the State of Education in India

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Abstract

The developing countries can attain sustainable growth by improving their literacy statistics. Knowledge makes a person literate enough to read and write, as well as it also improves the overall quality of life. There are a few Asian countries like India, Pakistan, Bangladesh, etc. where population is enormous, so any sudden change to increase the rate of literacy in the society is futile. The same was the case of Indian education system; which is/was suffering from very low literacy rate. The illiterate racy is so high that the conventional infrastructure present during earlier times cannot bring about a sudden change in the society. The extreme regional variations in culture, language, development and presence of very few well qualified teachers were some of the other limitations that were proving to be a big hindrance in solving the problem of illiteracy.

To solve this problem, Indian Government made use of the technology in the best possible way and launched a satellite named EDUSAT. It is solely designed, developed and launched to serve the exclusive purpose of imparting education to the entire India which includes both the rural and urban population. It is the first of its kind in the entire world and exemplifies how the use the technology can bring about a change in the society. It is used in all the levels for education from primary to secondary and also till the college. All the colleges which come under VTU are using it to provide a quality technical education to its student as there as is a dearth of high quality teachers in the country. Through EDUSAT, live audio- video interactive sessions are held between student and faculties. Through EDUSAT, live audio- video interactive sessions are held between student and faculties. Online classrooms, virtual schools, evening coaching classes, radio and television based classes are the new modes of educating people living in areas with poor infrastructures, electricity and efficient teachers It has not only improved the quality of technical education in these colleges but has also provoked an intense interest in the student in technological innovativeness.

This satellite has also proved to be very useful for primary and high school students and teachers as in the states of Gujarat, Tamil Nadu, Karnataka, etc. By this paper, we would like to highlight that how technology can change the entire face of a country. The approximate life of EDUSAT is just a decade but it has bring about a change in the status of the Indian education which otherwise would have taken more than a century by using conventional methods of teaching. The paper also highlights that how a country can improved its literacy with minimum resources. The use of technology in education has revolutionized the whole system of education.

Introduction

India is the second most populous country and holds one sixth of the total population of the world. It has the world's largest youth population with 50% of the total younger than 25 years of age. [10] This reflects that there are more than 610 million people, getting ready as a workforce who will change the course of not only India or Asia but entire World. The main challenge that India is facing is providing a resourceful education to this emerging workforce. This can only be possible by providing them a quality education so that they are skilled enough to not only earn their livelihood but can contribute to the development of the society as a whole.

India is among very few countries whose population is highest in the range of 15-19 as depicted by the population pyramid [11]. This pyramid helps us to understand the pattern of age distribution in the country. Below is the population of the 3 most populous countries of the world i.e. China, India and USA [12]. China shows an irregularity in the curve due to its stern one-child policy adopted in the last 2 decades. India has a broad curve till the age of 25 and then goes down smoothly. United States has almost constant distribution of age.

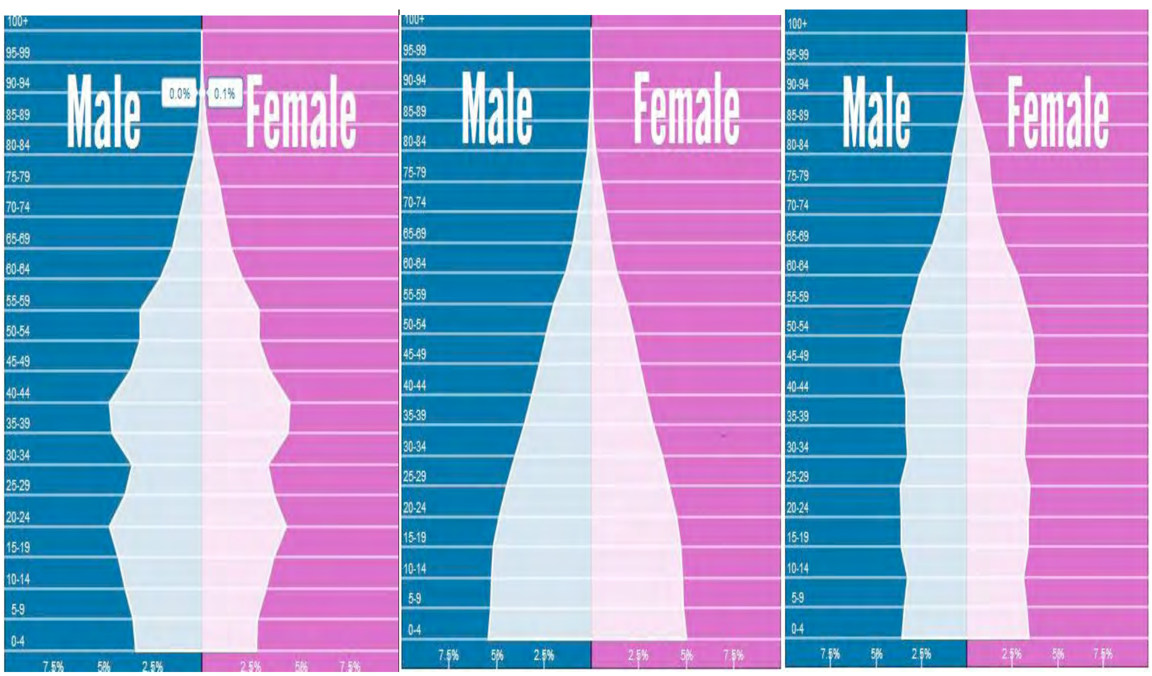

Fig 1.1: China Fig 1.2: India Fig 1.3: US

Fig 1: Population Pyramid of the three most populous countries of the World

Fig 1 depicts that India immediately require to strengthen its education policies as the majority of the population lies below the age of 30 which can only be done by using technology and e-learning. [13][14]

The country has nearly 86% male and 69% females literate with only 16% having more than 11 years of education. [15] The major drawbacks in long term education are the unavailability of proper education centers like schools and colleges in sub-urban and rural areas. At the student level, there is very unsustainable economic condition of the family.

On the other side, the basic infrastructures like school building, labs, etc. are not present in every locality and many villages are not connected with cities through concrete roads. These small towns and villages have no access to the resources available in bigger and metropolitans cities. Even after the government's initiatives of constructing roads and enhance the infrastructure, skilled teachers remain scarce.

Furthermore, there 8 north-eastern states of the country are home to 39 million people. The literacy level here is 68.5%.The states of Assam, Arunachal Pradesh and Meghalaya have literacy rate less than the national average. The land terrain, language barriers and other activities have prohibited easy entry of people from these states into other states and vice-a-versa. But the advent of internet, communication channels via phones, satellite and video conferencing into these states has opened new doors for advancement.

Fig 2 clearly depicts that one out of every four person in India is an illiterate. As more than 70% of the total population of India lives in rural area, the status of literacy cannot improve without targeting them.

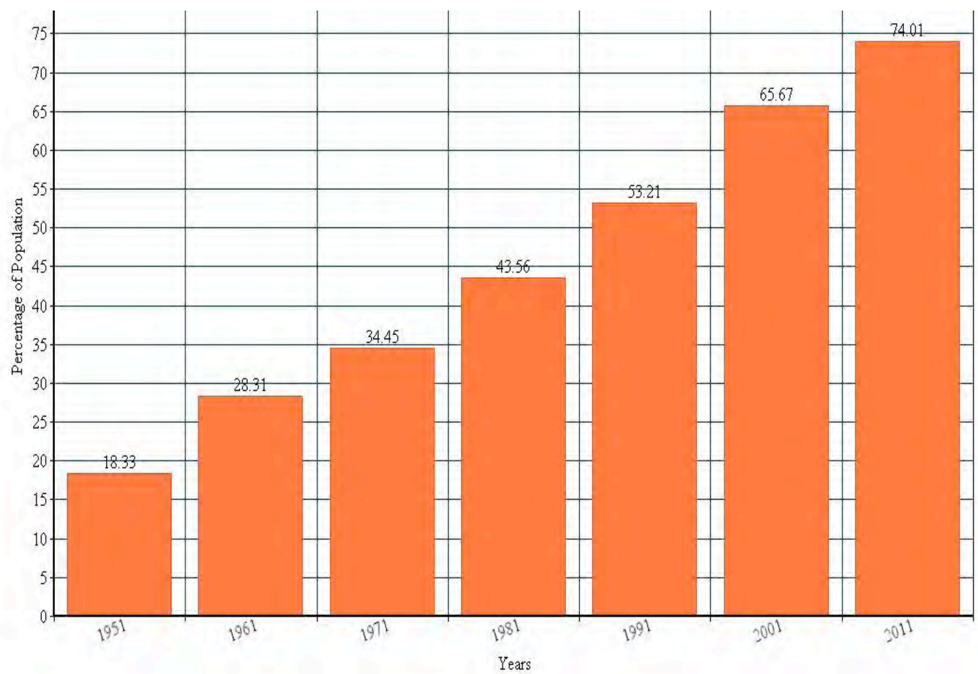

Fig 2: Literacy in India from 1951-2011

It is estimated that by 2020 more than 50% of the world's illiterate will reside in India. This made the government to take an initiative to introduce a mechanism through which education in the rural India is influenced the most. This paved the way for launching a satellite for spreading education to the remote areas and the under privileged people. EDUSAT thus came into existence and today promotes education to all parts of the country.

Education in Rural India

India is a federal government with 28 states and 7 union territories. The literacy rate varies a lot in the states as there are several states with more than 90% literacy rate like Kerala at the same time there are several where literacy is just over 60%. The same variation holds good in the rural and urban population.

According to the 2001 census of India, there are around 638,596 villages in India. These villages hold more than 68% of the total population of India. Although after the green revolution in India, the condition of villages has improved but still there is a long way to go. The literacy rate of rural India is just 68.9% and there are few states where literacy rate of rural population just touches 60%.

Year	Percentage of Rural Population	Year	Percentage of Rural Population
1960	82.1	1990	74.5
1965	81.2	1995	73.4
1970	80.2	2000	72.3
1975	78.7	2005	71.3
1980	76.9	2010	69.9
1985	75.7		

Table 1: Percentage of Rural Population in India with respect to total population

The condition becomes even worse if we take into account the female literacy in rural India. Out of 100 females only 58 are literate and there are several states like Rajasthan, Jharkhand and Bihar where this count is even less than 50. This is the most alarming situation, as with the conventional system of education it will take a long time to curb illiteracy.

States	Literacy Rate in Rural Female (in percentage)	Overall Literacy Rate (in percentage)	Difference in Literacy Rate
Rajasthan	46.3	67.1	20.8
Jharkhand	49.8	67.6	17.8
Bihar	50.8	63.8	13
Andhra Pradesh	52.1	67.7	15.6

Table 2: States with the Lowest Rural Literacy Rate in Female and their difference with Overall Literacy Rate

To summarize, the following demand for an inevitable technological overhaul which can solve all the above mentioned problems:

1. Huge youth percentage in total population. [Ref Fig: 1]
2. Literacy rate is India is quite low. [Ref Fig: 2]
3. A huge population resides in rural India [Ref Table: 1]
4. There is inadequate road network in villages.
5. Literacy rate of women is too low; specifically in rural area. [Ref Table: 2]
6. No proper infrastructure for schools.
7. The number of well qualified teachers is very less. [16]

For the above mentioned problem there was a requirement of a technique which could solve the entire problem in a quick span.

EDUSAT- A New Beginning

EDUSAT was launched on 20 September 2004; it is the first of its kind designed solely for the purpose of education. [1][2] It was launched to have an impact on the entire education system of India. It provides virtual classroom for the primary students located in remote areas, high quality and technical proficient lectures of reputed people in college and universities which lacked proper well qualified teachers. It also provides training to teachers and aids them with the current knowledge.

Fig: 3 Potential Use of EDUSAT

Specifications of EDUSAT

The geo-synchronous satellite, co-located with METSAT and INSAT-3C has total 4 solar panels of size 2.45 M × 1.525 M generating 2040 W (EOL), two 24 AH NiCd batteries for eclipse support [3]. It incorporates 3 axis body stabilized in orbit using sensors, momentum and reaction wheels, magnetic torques and eight 10N and 22N reaction control thrusters. Its propulsion capacity is 440N Liquid Apogee Motor with MON-3 and MMH for orbit raising purpose. Other details include five lower Ku band transponders for spot beam coverage-effective isotropic radiated power (EOC-EIRP). Six upper extended C-band transponders for national coverage with 37db W EOC-EIRP. One Ku band Beacon to help ground users for accurate antenna pointing and uplink power control .The mission life is minimum 7 years. Its uplink facility has been developed at DSERT Bangalore. The downlinks provided in schools are provided with solar power facility. This takes care about the power problems.

EDUSAT- Changing the conventional education system

The mission is monitored by ISRO (Indian Space Research Organization) and also the Sarv Shiksha Abhiyan. [4] [5] in these states also, specific geographic regions and areas are identified for the virtual classrooms. The hardware required at community level is a computer system with a webcam, mike and speaker and LAN for internet connection. Projectors, screen, Osprey Card, NVidia Card are the technical requirements.[6][7] Its network is spread through schools, higher secondary and colleges, professional universities, state capitals and places with only its receiving terminals. The schools have only RECEIVING terminal, higher secondary and colleges have satellite interactive terminal, state capitals have hubs and for the already existing networks, direct reception system to cater televisions and landline phones.

As mentioned above, there are various uses of the satellite EDUSAT in the field of interactive communication and spreading education along with awareness about social issues, health sector and entertainment. Other sectors include night time loading, video conferencing, Talkback channel as return link, asymmetric TV Internet through TVRO. [8][9] Since the satellite functions throughout the day, people can study at any time, any place and any topics of interest. The mobile education has been successful in enhancing the reading and writing ability of people in rural areas where no school exists. It does not require the students to pay any fee and motivates enthusiastic study in the field of interest of the student.

The minor drawbacks are very few and are only at the receiving side. The users are naïve computer users and technically sound people are very few. For this, the governments in various states have started facilitating non-government organizations that send their teams in remote areas and help in the setup of such technical systems.

EDUSAT is an interactive medium. It uses videos, web based seminars, chats etc. By these, the students are able to convey their point of views and also let the instructor enhance their mode of teaching. Such virtual coaching has also taught various people to operate minor injuries and ailments in rural and remote areas. These places do not have proper amenities such as city development authority and dispensaries. They are also spread awareness about the need to build washrooms in the house. By these classrooms, not only literacy, but living standards and societal norms are also improving. It appears to bring a digital revolution in lives of those, who are still untouched by the advances in technology. There are two ways, synchronous and asynchronous. Asynchronous is through CD-ROM, document and e-books, bulletin boards etc. these can be used at any intended time. The synchronous mode is under use when a teacher is guiding and the students have to be present in the temporary classroom to listen and reciprocate his views and answers.

The communication satellite provides interactive classes to the people living in remote areas. Here electricity, school infrastructure and skilled teachers are scant. Since such basic resources are unavailable, the respective students also show low enthusiasm and morale to join such study programmes, where they have to attend a virtual class. Their self-motivation is the only driving force. All the states used EDUSAT for its own unique needs to improve the condition of education in their respective states. Moreover, it was a very economical investment for improving the literacy rate in the state and improves the quality of education imparted to the students.

Role of EDUSAT on Students

In Haryana

EDUSAT was launched in Haryana with 3.8 meter antenna for uplink at Panchkula. The teachers take the class from the studio at Panchkula, which is transmitted to the EDUSAT satellite. This is then further transmitted by EDUSAT to entire state of Haryana.

These lectures are received by 9000 Primary Schools, 1250 Secondary Schools and 92 Government- aided College through Satellite Interactive Terminals. Initially live lectures were provided which was further enhanced to record as well [17]. Apart from prescribed course several various other course like training for engineering entrance exam and soft skills development courses were also provided. Moreover a test was also conducted periodically to evaluate the progress of students. To propitiate interests among teachers, coordinators and students; prizes like "Best Questions Asked by Student" & "Best Teacher/ Coordinator" are given.

Fig: 4 An Interactive virtual class where teacher is teaching from studio to the college students transmitted through EDUSAT

Impact in Haryana

1. Better performance of students in exams.
2. Timely coverage of syllabus.
3. More interests and involvement of students.
4. An increase in the attendance status of students.
5. Uniform standard of teaching to all the students both urban and rural.
6. High class and reputed teaching staff took the classes.

In Gujarat

EDUSAT is extensively used in Gujarat to provide educations to masses. A total 22,000 primary schools were linked to the satellite to improve the education. The Chief Minister of Gujarat is using EDUSAT as a channel to interact with 40,000 teachers once every month [18]. This mode of education was so popular among the student that ISRO has to increase the bandwidth by six times as per the request from the Gujarat. A network for blind people's association was formed using this satellite covering 10 schools. EDUSAT aims to provide the following functions in Gujarat:-

1. A uniform primary education to all the rural schools.
2. Provide training to teachers about the latest teaching technologies.

3. Providing training to health-care staff especially nursing.
4. Increase the interests of students in studies.
5. Helping the blind students by making specialized lectures for them.

In Karnataka

EDUSAT is used by most in Karnataka. Here a separate e-learning center is established in Visvesvaraya Technological University (VTU) where all the 120 engineering colleges are linked up via EDUSAT [19]. Here the engineering students have the benefit that can interact with the best resource person for their subject. More than 1000 lectures have been completed. Web- based e-learning have prepared the course for 12 full semester subjects. For the primary education too, EDUSAT with the help of a scheme named "Sarva Siksha Abhiyan" has covered 885 primary schools.

Fig: 5 E-Learning to college students

In Kerala

Kerala was the first state which made use of EDUSAT in 2004 [20]. A dedicated EDUSAT lab was set up and introduced the concept of virtual university. After being associated with Kerala University, live interactive sessions have started with students to impart quality education.

In Punjab

Punjab is one state which is most efficiently utilizing the satellite. A studio is built to facilitate the smooth working of the e-learning activity. A special grievance section is working to regularly note the evaluation process. A special programme for the students giving engineering entrance examination is prepared which is helping the students who are unable to pay heavy fees to private organizations. Recently 2960 schools of Punjab were linked to EDUSAT to get the service of live interactive lectures [21]. A special study material for all the lectures were prepared to have a better understanding of the lectures.

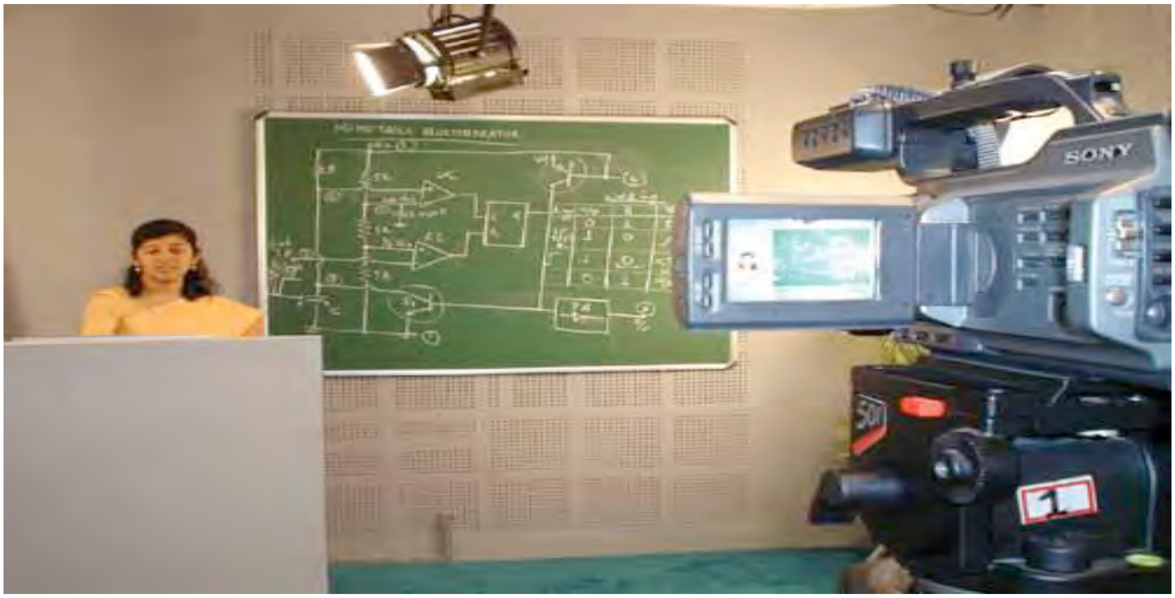

Fig: 6 A lecture being prepared at a studio to be broadcasted by EDUSAT

In Madhya Pradesh

This was the most advanced use of EDUSAT. Here EDUSAT was introduced by the forest department in Jan 2008. This was done to provide training to the forest officials to increase efficiency of forest officers, employees, and dwellers through online training and discussion. 52 Satellite Interactive Terminals (SITs) have been set up for 27000 forest employees and forest communities.

Including Artificial Intelligence in Satellite for future

The huge data that is constantly being transmitted and received by the satellite gives opportunities to the scientist to test the new patterns of education to the young students. One such way is the use of artificial intelligence into the satellite. It can simulate and recognize the change in number of students per class. They also store information on the level of questions being asked by the students in a class. This makes the class more dynamic in terms of interaction. The inclusion of artificial intelligence make possible to revise the syllabus of the students based on their own interests. The interactive tests provide a clear idea about the topics which require further attention by teachers.
Framing of questions, their evaluations, allotment of faculties, deciding the syllabus all can be done in an automated manner by including advance technology in this satellite like AI.

Conclusion

In being a developing country is using the technology in the best possible way to increase the education status. This is mode of providing education to masses with very less resources proves to be highly beneficial for all the countries who want to raise their stand of education. A small investment that was done for development of this satellite has proved to be the best asset in the Indian Education. Here through this paper we have been able to understand that how technology can change the whole scenario for education. This satellite is proved to beneficial for all the sections of the society and service a large variety of audience. Due to its over-whelming success, we should expect that there would be more countries which will involve themselves and there will be a day where a group of satellite can serve the whole of world for all its educational need.

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New Pedagogical Models Facilitated by Technology

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Abstract

This paper discusses the outcome of research conducted to assess the effectiveness of Work-Based Learning (WBL) from the perspective of stakeholders. WBL has increasingly become an area of interest for the higher education (HE) sector. It can support the personal and professional development of students who are already in work. The focus of the learning and development tends to be on the student's workplace activities

Previous research has mainly considered only two stakeholder contexts namely the learner and the academic institution. The significance of the study stems from extending the stakeholder contexts to include the employer and the professional body. The aim of this study was to assess the effectiveness of delivery of WBL from the perspective of a range of stakeholders including students, *programme leaders (PLs), tutors, university support services, employers and representatives of professional bodies.*

Case study research methodology was adapted with mixed method research techniques for data capture and analysis using both qualitative and quantitative approaches. The study examined five (5) WBL programmes at Northumbria University in the UK. The three most influential factors in the effectiveness of WBL were found to be: quality, access and support.

The contribution to new knowledge in WBL research is through a "Four-Pillar model" which has been developed to reflect the stakeholder contexts. Consideration of this model helps ensure WBL programmes cater for the current demands from the labour market. The findings of this study include factors which facilitate and/or obstruct the effective implementation of WBL programmes whilst identifying feasible strategies to overcome those challenges and share them with all stakeholders of WBL. Recommendations are made on resolving the identified issues and to extend and improve the effectiveness of WBL. Finally this paper looks at how these results could apply to encourage WBL uptake in a third world developing country like Sri Lanka where you are starting from a zero base. Sri Lanka is yet to embark on WBL formerly although online distance learning is more of a reality.

Key Words *Effectiveness, Higher Education, Work Based Learning, Stakeholders, Technology in Learning, Case study research*

1. Introduction

Work-Based Learning (WBL) is the term used to describe a class of university programmes that bring together universities and work organisations to create new learning opportunities in workplaces [1]. Such programmes meet the needs of learners, contribute to the longer-term development of the organisation and are formally accredited as university courses. According to Durrant, Rhodes et al. [2, 1] WBL focuses on learning in and from the workplace where work, rather than a set curriculum, provides the focus for the learning programme [3].

A paradigm shift has taken place in Sri Lanka with the leap from traditional print based distance learning to technology enabled online learning within a short period [4]. The National Online Distance Education Service (NODES) which was launched in 2007 has a large potential that has yet to be realized in servicing the education sector, employers and employees to meet their WBL needs [5].

2. Problem Statement of the Research

Although the WBL concept has been in practice for some time, a review of the literature highlights a focus on the learner and the tutor with some consideration of the employer [6] [7] [8]. This study aims to contribute new knowledge of the WBL process by considering all four stakeholder contexts in one model: the learner, academic, employer and professional body.

3. National Online Distance Education Service (NODES)

The Distance Education Modernisation Project (DEMP) funded by the Asian Development Bank was launched by the government of Sri Lanka under the Ministry of Higher Education to modernize the distance education system in the country in 2004. The National Online Distance Education Service (NODES) [5] established by DEMP is intended to provide all online distance education services to the nation.

NODES on one side supports online programme development for universities and any other public or private sector post secondary educational institutions through its Content Development Unit (CDU) which has been staffed with experts in online content development [9]. NODES also facilitates the delivery of programmes through its state-of-the-art high speed network running on IP/VPN technology.

Lessons learnt from the current study of WBL programmes in the UK could be usefully applied to NODES to extend its application to WBL.

4. Methodology

The approach applied in this research is case study methodology with mixed method research technique. According to Pickard [10, 85] a case study can be both the process engaged in to investigate a phenomenon and the written output of that investigation. Yin [11, 1] further explains that case studies are preferred as the research strategy when the investigator has little control over events. This is true with this study as the investigator has no control with the delivery of WBL programmes at Faculty of Engineering and Environment (FEE) at Northumbria University being an individual researcher.

Five (5) WBL programmes of disciplines of Professional Engineering (PE), Information & Communication Technology (ICT), Records Management (RM), Information & Library Management (ILM) and Librarianship at Northumbria University have been selected. The first four of these disciplines are post graduate programmes whilst the fifth is an under graduate programme.Firstly, students on the WBL programmes were surveyed using an online questionnaire. This was an appropriate technique given the relatively large number of students. The resulting data analysed using statistical analysis techniques. Secondly a range of stakeholders involved in the WBL process were interviewed and this data was analysed qualitatively.

The details of the selected programmes are given in Table 1.

Table 1 The details of selected programmes

Professi-onal Engineer-ing (PE)	MSc Professional Engineering has been developed as part of a UK Government funded initiative and on behalf of The Engineering Council with the programme wholly taking place in the workplace and is directly relevant to what students are working on, for example as practicing mechanical, electrical, manufacturing or building engineers, whilst furthering their education and working towards professional body recognition and eventually chartered engineer status.
Information & Commu-nication Technol-ogy (ICT)	This MSc course is suitable for students in employment seeking to gain a solid grounding in a range of skills and techniques that are relevant to the computing and information technology industry. These include learning SQL with the Oracle RDBMS; the Java programming language; (X)HTML, CSS and PHP for web development; and the Unified Modelling Language.
Records Manage-ment (RM)	This MSc programme balance of the knowledge demanded and the immediate skills needed for managing information and records in the increasingly complex electronic environment and dynamic organisational contexts. Subjects studied cover contemporary theory and practice of managing records in the digital environment as well as broader management, risk, legal and ethical contexts.
Information & Library Manage-ment (ILM)	This distance learning PG Dip./MA/MSc programme is aimed at people working within an information environment, who wish to professionally qualify at postgraduate level. It is designed to produce information professionals able to take leading roles in the rapidly developing world of information and library management, by developing the knowledge and skills needed to handle effectively the storage, retrieval, analysis and communication of information.
Librarian-ship (Lib)	The BSc in Librarianship is a work based learning programme aimed at people working in libraries who wish to take the first step on the career ladder by obtaining a degree level qualification in the subject area. Entry is normally at level 5, and admission is normally based on substantial experience in libraries, and an ACLIP/portfolio.

The results from quantitative and qualitative analysis were triangulated for final outcomes. Triangulation is achieved within the case study by using multiple data collection techniques ‘to pick triangulation sources that have different biases, different strengths, so they can "compliment" each other' [11]. It also serves another purpose as Yin [12] claims 'to collect information from multiple sources but aimed at corroborating the same facts or phenomenon'. Therefore, interviews, questionnaires and their analysis were able to achieve triangulation. As Pickard [10, 95] further explains, survey research can include qualitative and quantitative research hence *mixed methods* was adopted as the *methodology*.

5. Quantitative Analysis

The details of the online student questionnaire results are given in Table 2.

Table 2 The details of the online student questionnaire results

	MA/MSc in ILM	MSc in PE	MSc in ICT	MSc in RM	BSc in Librarianship	**Grand Totals**
Total no. of students	76	14	40	25	33	**188**
No. of responses	36	06	11	07	12	**72**
% of responses	47	43	28	28	36	**38**

The current study uses three variables as main building blocks or enabling factors for a good learning experience:

- Quality (learning materials, delivery, teaching/tutoring, Acceptance /credibility)
- Access (programme content, Programme leader, Tutors, Mentor at workplace, peer students, university services)
- Support (University, Employer, Professional Body, family, peer students)

The collected data were subject to univariate and multivariate statistical analyses including Frequency analysis, Spearman correlations, Factor analysis, and Classification Analysis of Regression Tree (CART).

6. Qualitative Analysis

The qualitative analysis was carried out with the data obtained from interviews conducted with a range of stakeholders involved in the WBL process: students, programme leaders, module tutors, and support services staff of the university, mentors and supervisors from workplace and representatives of professional bodies. The interview sample is shown in Table 3.

Table 3 Summary of stakeholders interviewed

Category of stakeholders	Number of Interviewees
Programme Leaders	05
Tutors	07
Employers	06
Representatives of Professional Bodies	04
Students	11
Support Staff	07
Total	**40**

8 main themes and 3 sub themes which emerged from qualitative analysis as shown below.

6.1 Use of Technology in Learning

Liyanage, Pasqual [13] illustrate that the use and expectations of various stakeholders in a technology-based learning environment are very different from each other yet are rarely addressed. The following areas emerged as most important from the data.

6.1.a Use of Virtual Learning Environments (VLEs)

Based on a Blackboard VLE, the eLearning Portal (eLP) is the main mechanism for supporting the delivery of learning and teaching and is used to replace the physical classroom environment for these learners. Students and tutors had contradicting views on the user friendliness of the eLP. Among students 62% were happy about the user-friendliness of the eLP while a further 27% were neutral. This contrasts with the results of the interviews held with academic staff that generally held quite negative views on using the eLP which included: "*I wouldn't say it's perfect: it's clunky and too many functionalities, which takes a lot of time.*" and *"It's tedious to upload attachments because you cannot upload more than one at a time"*

One reason for this is students primarily access the eLP as users to contribute to online activities and study content. Academic staff access the eLP to set up modules, populate and manipulate them to provide online content and activities for the students. Their views reflect the difficulties in using the eLP from a control and management viewpoint rather than as a learner.

6.1.b Quality of Online Content

The quality of content at the outset is a crucial element of any online WBL delivery. The following view from the Students' Union reflects this "*How WBL students could benefit is to have good quality interactive study materials on the VLE by lecturers across modules and across schools*". Strother [14] in her paper describes *"Another way of approaching the attempt to guarantee better results in online learning programs is to look at content quality measures, i.e., the quality of the online education product itself"*. How students feel about it is *"There was very little multi-media stuff in the content. I felt I lack the online interactivity which could have been easily embedded using today's available technologies"*.

However using technology for technology's sake could detract from the real learning content, frustrate users by creating slow download times and require them to have high-spec PCs and a range of helper applications to be able to access the materials [15]. One of the tutor comments also reinforced this "*Technology should not drive pedagogy but pedagogy should drive technology"*.

6.1.c Equality of Online Standards across the Board

A key finding from the study was the observation of large differences in the standards of delivery of WBL among the programmes. This was seen in online content, tutoring, delivery, assessments as well as support. For example tutors had different views on the response time for student queries: *"I normally work from 7.30-5.45pm on weekdays and usually respond to students during that time window. I do check emails sometimes at weekends."* and *"I usually give Monday 11-12 for DL students to contact me online live but I reply to them during the week but not during weekend".*

6.2 Tailoring of Learning Contracts

The tailoring concept is one of the unique features of WBL and is a main attraction for employers and employees. The students' learning contracts are customised to their work role and responsibilities. One tutor comments "*The tailoring concept is great but when numbers are high it would be difficult with the time and resource limitations. Another important aspect of this would be quality control because students' tailor made curricula have to be equally balanced/standardised according to the programme benchmark levels"* which reminds us to be cautious in trying to tailor curricula.

6.3 Student Isolation

Student isolation is one of the main critiques against distance learning and grievances from distance learners [16]. However, WBL differs slightly by being learning at the workplace as there is often a mentor/supervisor present. This was observed in the study but not for all programmes. A student comments *"Occasionally I felt isolated and less motivated so in those types of occasions it's better to have some face-to-face contact/advise from someone. I visited the university twice once for induction and just before the project which I found very useful. Had I missed them, it would have been difficult to establish the relationship with academics and colleagues which is very important irrespective of mode of learning and I would have found it very hard to keep motivated and even it could have affected the completion of the program".*

6.4 Effectiveness of Delivery Mode

The contextual variations are much wider in WBL where each student's working environment is different compared to traditional learning environments [17]. A comparison between face-to-face learning, 100% online learning and blended/hybrid learning was analysed in terms of university support, performance of students, learning content, tutor performance and preferences, student collaboration/interactions, etc. The majority of students favoured face-to-face meetings, i.e. blended learning as much as possible to enhance the understanding, collaboration, inclusiveness and ownership. As one student comments *"In face-to-face, you always get the opportunity to correct yourself when you meet up with someone but in online self-learning you don't know whether you are on right path*"

6.5 Accreditation of Prior Learning (APL)

Accreditation of Prior Learning (APL) is one of the innovative and radical inclusions in WBL [18]. The students view this positively: "*I benefitted out of APL immensely which led the university to exempt me from first year due to my other relevant qualifications and also number of years of experience. I think it's a great concept for people who couldn't pursue HE due to various reasons but are capable and experienced enough in the latter part of their lives to acquire higher qualifications."* A tutor commented on the negative side of it: *"loathe doing it because it is very difficult to assess and compare what they have done in order to exempt them from a module or a year". [19]*

6.6 University Support

It is vital that universities recognise the importance of this mode of education and provide due recognition and technical support wherever possible. As one tutor remarked "*University provides loads of training but I don't have time. Would like to use Podcasts and video clips in my materials but the time is the constraint again."* It was apparent that a lack of confidence, technical expertise and other priorities interfere with academics' ability to do this.

6.7 Employer Support

WBL is directly related to the employer and workplace hence employers' support in many ways can impact on students' learning and performance. As one tutor commented "*without supervision in that level of professional context student wouldn't know what to learn and also what's the best way of doing certain things. Also, the student would need supervision from a person in the workplace who has certain level of authority to reflect and evaluate the actions student would perform*".

6.8 Professional Body (PB) Support

The active involvement of the PB in the process is a key requirement for the success of WBL delivery. The universities should proactively work with PBs. As one PB highlighted "*what candidates should do when they plan to start WBL MSc programmes is to inform us about their learning contract through the university so that we can approve it which makes them feel comfortable that once completed it would satisfy academic requirement for professional registration.*"

7. Triangulation

Triangulation is achieved not only between qualitative and quantitative outputs but also between different quantitative analysis techniques mentioned above. Table 4 below shows the independent themes/sub themes that emerged from this triangulation.

Table 4 Triangulation between qualitative and quantitative analyses

Quality	Support	Access
• Quality of online content	• Tailoring of learning contracts	• Use of VLEs
• Use of technology in Learning	• University support	• Student isolation
• Equality of Online	• Employer Support	• Effectiveness of

standards across the board		Delivery Mode
	• Professional Body support	• Accreditation of Prior Learning

8. Original contribution to knowledge

Figure 1 Suggested Four-pillar Model

This study looks at four pillars of WBL: the learner, the academic environment, the workplace and the professional body which is called the four-pillar model in WBL (Figure 1). The findings from this study show that a number of factors facilitate and/or obstruct the effectiveness of WBL including the remoteness of the learners. The rapid development of ICT in the 21st century offers a successful means to address some of these issues but the pace of professional development of learners and academics in these technologies is much slower and thus pose a challenge in exploiting technology to its full potential.

Recommendations from the study

Accordingly, recommendations as a way forward for a new pedagogic model for all the stakeholders who are involved in the WBL four-pillar model are proposed. Due to the limitations in terms of this conference paper, only the main key recommendations per stakeholder are presented.

1. **Learners**
   1. WBL is a totally self-driven exercise hence the self-belief, commitment, dedication and motivation are essential ingredients
   2. Setting up the learning contract between the student, employer and the university needs careful attention to foresee student's work role and align those activities with the academic standards and learning outcomes with some scope for flexibility
   3. Before committing to a WBL programme, obtain consent of the PB for the learning contract to align with the PB's accreditation benchmarks

2. **Academic Institutions**
   1. Appreciate and timetable staff appropriately for WBL
   2. Institutions should enhance central technical support for WBL support
   3. Improve ease and speed of online access to university resources
   4. Establish quality assurance and monitoring systems

3. **Employers**
   1. Assess the company's training/development requirements before embarking on WBL programmes for employees
   2. Conduct cost benefit analyses to assess the best option for the company between in-house WBL and out-bound short-term training
   3. Provide inputs for the employee's tailored learning contracts
   4. Assigning a mentor for the employee
   5. Establish a monitoring mechanism at workplace

4. **Professional Bodies**
   1. Accredit, approve and formalise the various academic and training endeavours of potential candidates

ii. Intervene early in the WBL delivery process with the employer, employee and the university and indicate any due requirements for employee's professional registration
iii. Streamline policy framework and standards so that WBL qualifications are fairly treated across the board

Recommendations for Sri Lanka to embark on WBL

The following recommendations are derived for Sri Lanka from the UK study.

1. In general, education authorities and employers should realize the importance of WBL and formulate new policies and / or strengthen existing policies to promote online WBL in Sri Lanka.
2. A strong commitment by the Government is required to make policies and procedures that recognise online distance learning credentials as being at least equivalent to credentials earned in traditional ways.
3. Problem of lack of elementary computer literacy throughout the country must be addressed in the online WBL planning process together with rationalised bandwidth distribution. This is a key difference between the two contexts where the UK being a developed country, is far ahead of Sri Lanka in terms of IT infrastructure facilities and computer literacy of the population.
4. More rigorous marketing is essential for this by all potential stakeholders including NODES, Universities, employers, and professional bodies.
5. Quality assurance systems must be established and monitored right through in order for this system to stabilize and sustain. This is also necessary in the UK context as students and academics had negative views on the quality of content and support from the university.
6. Tutors are required to provide timely, and constructive feedback which should be monitored from time to time. This was seen a problem in the UK context as well.

7. Institutions should also make a rigorous effort to develop quality multimedia-rich online content to create interest among students. It is important to provide technical support/expertise to enable academic staff to fully utilise what is available such that the content is left for academics, but the technical aspects be left to those with the technical skills. However this requires investment in support staff.
8. The use of Virtual Learning Environments (VLEs) in WBL compensates the problems of distance delivery. The tools, such as the Discussion Board, chat rooms, digital drop box for submission of assignments etc in VLEs optimise the use of technology. Also, video streaming and conferencing & simulations can be used to make students feel as if they are physically together. Nevertheless, blended learning is preferred by students in the UK which could be same in Sri Lanka.
9. The difference between a tutor-learner based existing online learning model in Sri Lanka and the proposed WBL model is the active involvement of employers, and professional bodies in the latter to encourage employees to take up WBL actively. This gap can be bridged by recognising and accepting the WBL model nationally such that universities and other stakeholders could collaborate in initiating industry-oriented WBL programmes in Sri Lanka.

Future Work

The post-study aims to develop a technology toolkit to benefit all four stakeholders in the four-pillar model to improve the pedagogical process. In recent years there have been increasing developments in technology to support educational provision but this is usually focused on the learner and/or tutor. Less research has been conducted on the use of technology to support other elements of the learning process. Therefore, the four pillar model and findings from the current research project will be used as a basis to evaluate how technology can be used to support the WBL process for the range of stakeholders: learner, academic institution, workplace and professional body. The JISC funded Lifelong Learning and Workforce Development Programme launched a similar toolkit [20] to support the HE/FE sectors in enhancing WBL provision. Institutions are able to use this WBL maturity toolkit to:

- Assess their current performance in WBL
- Identify a vision for WBL
- Identify the “enablers” and “barriers” to achieving the vision
- Develop recommendations for actions and change management

Similarly, the tool kit should be expanded to cater for all other stakeholders involved in the WBL process. So the idea of extending the WBL kit could form the basis for one that could be used globally including in developing countries.

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e- University: Bridging the Equality and Opportunity in Education for All

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Abstract

This paper examines the practices of Ramkhamhaeng University (RU) towards e-University. Based on the principle of "equality and opportunity" in education for all. And also provides opportunities for Thais residing overseas, having been in 33 countries worldwide. RU has developed teaching and learning systems; both on-campus and distance learning, using radio; televisions; mail, internet, e-learning, e-Testing, e-Books, Mobile Phone application and Mobile University (IT coach) driving along with a satellite truck, servicing both students and the public. Since 1971 it has produced nearly 900,000 graduates in all, which has assured its status as an "academic marketplace" with admission open to all .As technology in education has been providing opportunity to remote-areas student nationwide, e-University option is becoming increasingly popular at various universities.

Key words: e-University; *equality and opportunity*, *education for all.*

Ramkhamhaeng University Background

Ramkhamhaeng University (RU), the country's largest public university, was established in 1971 following a crisis in the quest for higher education. It was named after King Ramkhamhaeng, the great, Thailand's first monarch who has greatly contributed to the kingdom, renowned for inventing the Thai alphabet. Based on the principle of "equality of opportunity" to all regarding higher education, Ramkhamhaeng University provides teaching and learning system both on-campus and via distance learning.

The launch of distance learning via satellite (using a two-way video-conferencing system) for the regional campuses, for both undergraduate and graduate levels at Ramkhamhaeng University, has been a great success. One of the university's objectives is to produce graduates with the requisite knowledge, skill and moral values. One with a global requisite for academic excellence, which has assured its status as an "academic marketplace" with admission open to all.

The university teaches a wide number of subjects in the social sciences and humanities and also offers courses in all the major branches of science as well, including engineering and health science, and provides international programs, both at the undergraduate and graduate levels. This is a goal that Ramkhamhaeng University is continually striving to achieve without compromising academic in any way.

At present, Ramkhamhaeng University offers Bachelor's Degree Programs, Master's Degree Programs, PhD. Programs, International Programs and Pre-degree Programs in 11 Faculties and the Graduate School. In addition, the university also provides a wide range of excellent academic and administrative support facilities, total of 20 Institutes/Offices/Centers.

Provides equality of opportunity in education for all



The main campus of Ramkhamhaeng University was established in 1971 on an area of land covering approximately 120 acres, located on Ramkhamhaeng Road at Hua Mark in an eastern suburb of Bangkok Thailand.

Ramkhamhaeng University Bang Na Campus was established in 1984 on donated land covering approximately 60 acres, located on the Bang Na-Trad Highway, about 25 kilometres from the main campus of Ramkhamhaeng University at Hua Mark. Classes for freshmen are conducted at this campus, as well as for graduate students studying in certain fields, while classes for students from the second year onwards are held on the main campus. The facilities there are on par with those available at the main campus.

Ramkhamhaeng University Regional Campus in Honor of His Majesty the King is to mark the occasion of the 50th Anniversary Celebrations of H.M. the King's Accession to the Throne and **60**th Anniversary celebrations of H.M. the King's Accession to the Throne. Given its long-standing commitment to providing equal opportunity in the field of education for all Thais, especially, those who have long lacked such opportunities, since 1995, guided by the vision of the Former President, Associate Professor Rangsan Saegsook.

At present there are 22 regional campuses, all of which function as part of the Ramkhamhaeng University System. All campuses, serving as both academic and cultural centers, not only provide regional and local access to academics on campuses, but also strengthen closer ties with the surrounding community through a variety of cultural activities.

All regions of Thailand, as well as 37 regional examination centers, the university provides various Special Programs at the Bachelor's and Masters Degree levels, as well as short-courses, in 44 province, as well as in Bangkok; Ramkhamhaeng University's Special Programs are well-known and constituted a role model for supporting lifelong learning for all. The overall aim is to make a wide variety of academic services available to the community and to society at large, and to foster the development of human resource, both in the public and private sectors.

The Institute of International Studies (IIS) offers various English and Chinese programs. All courses are taught by experienced visiting Professors and lecturers from leading universities overseas, who take turns to come and lecture at the IIS. Currently, about 2,200 students have enrolled, consisting of both Thais (35%) and overseas students (65%) from 74 countries worldwide. (http://www.iis.ru.ac.th , 14 February, 2012)

Overseas Academic Services

(RU: Thailand’s Global University, 2012, p.1)

The university also provides opportunities for Thais residing overseas, having been in the process of expanding Ramkhamhaeng University worldwide since 2003; as a result, the university provides undergraduate and graduate programs of study for Thais in 33 countries worldwide, having 40 examination centers in those countries.

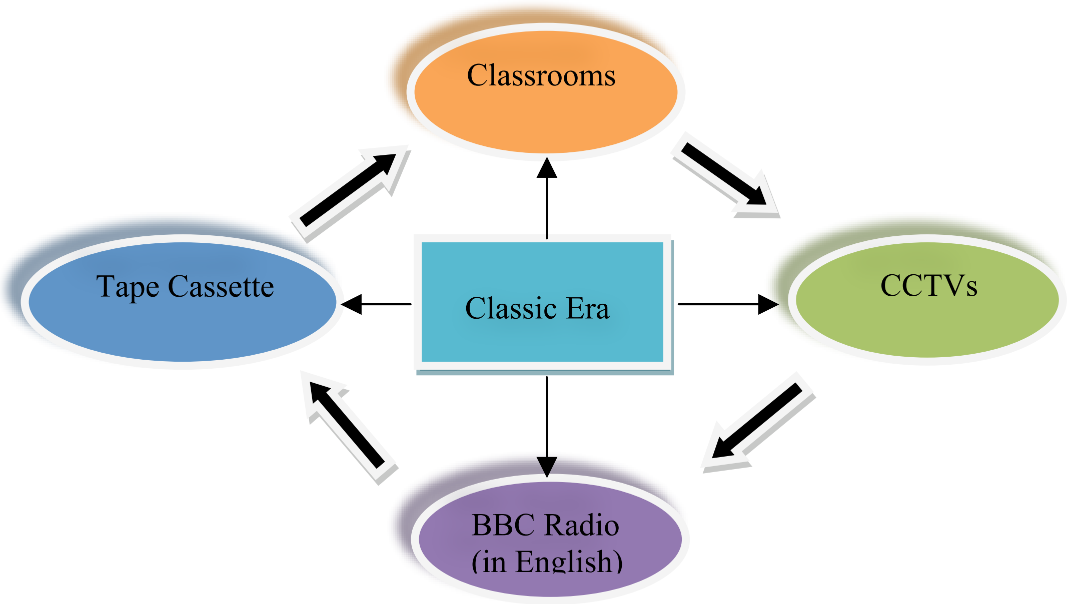
Total of 40 Overseas Examination Centers:

Canada: Ottawa, Vancouver, USA: Washington DC, New York, Los Angeles, Chicago, Belgium: Brussels, France: Paris, Germany: Berlin, Frankfurt, Iceland: Reykjavik, Italy: Rome, Netherlands: The Hague, Poland: Warsaw, Spain: Madrid, Switzerland: Berne, The Republic of Austria: Vienna, United Kingdom: London, Denmark: Copenhagen, Finland: Helsinki, Norway: Oslo, Sweden: Stockholm, Kingdom of Bahrain: Manama, Oman: Muscat, State of Qatar: Doha, The United Arab Emirates: Dubia, Australia: Canberra, Sydney, New Zealand: Wellington, Cambodia: Phanom Pent, India: New Delhi, Japan: Tokyo, Osaka, Malaysia: Kuala Lumpur, People’s Republic of China: Beijing, Guang Zhou, Xiamen, Republic of Korea: Seoul, Singapore, Vietnam: Ho Chi Min, etc. (http://www.ru.ac.th/oasc)

Teaching and Learning Systems

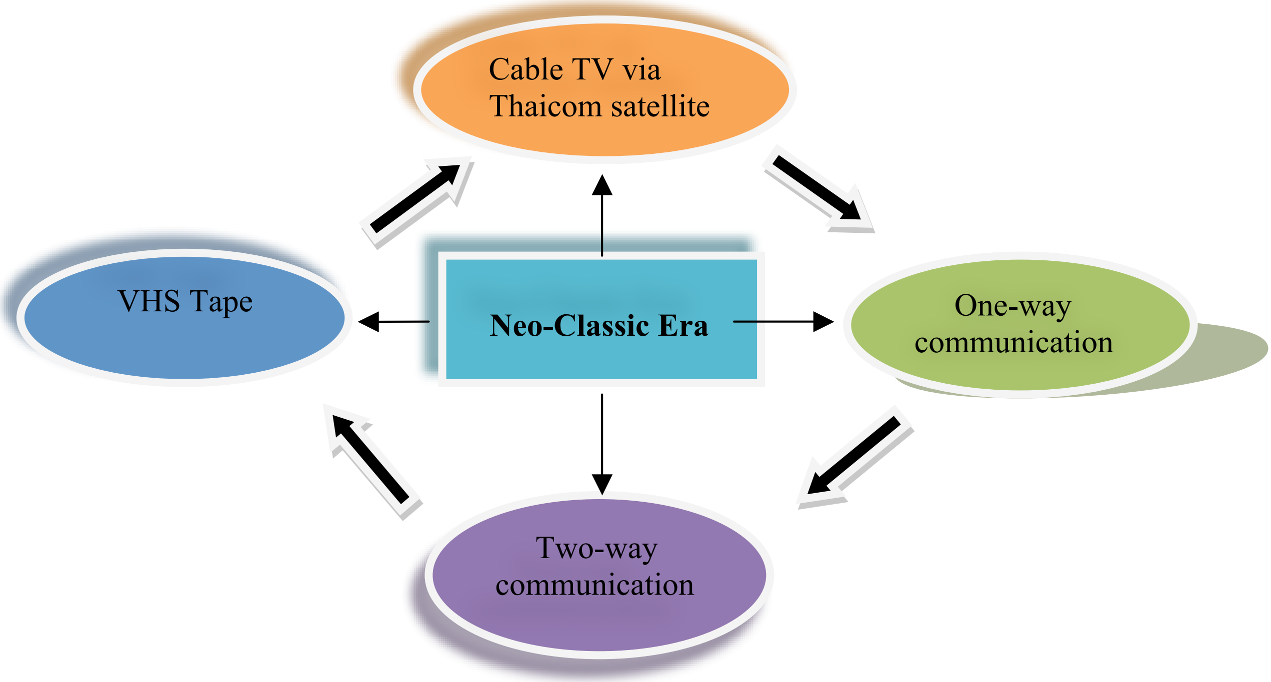
Ramkhamhaeng University has for a long time offered its students two systems of instruction, in the form of both on-campus and distance learning, a field in which it has had extensive experience – long before it became fashionable among the educational community. Various modes of instruction have been adopted at Ramkhamhaeng University; the main system of instruction being a combination of on-campus instruction and distance learning via satellite, internet, mail, radio, television, e-Learning, e-Books, Mobile Phone and other forms of modern information technology. Students may choose the mode of instruction that best suits their individual needs.

To more effectively illustrate how teaching and learning have evolved under the umbrella of Ramkhamhaeng, here are different sets of models to describe different eras and their respective academic practices;



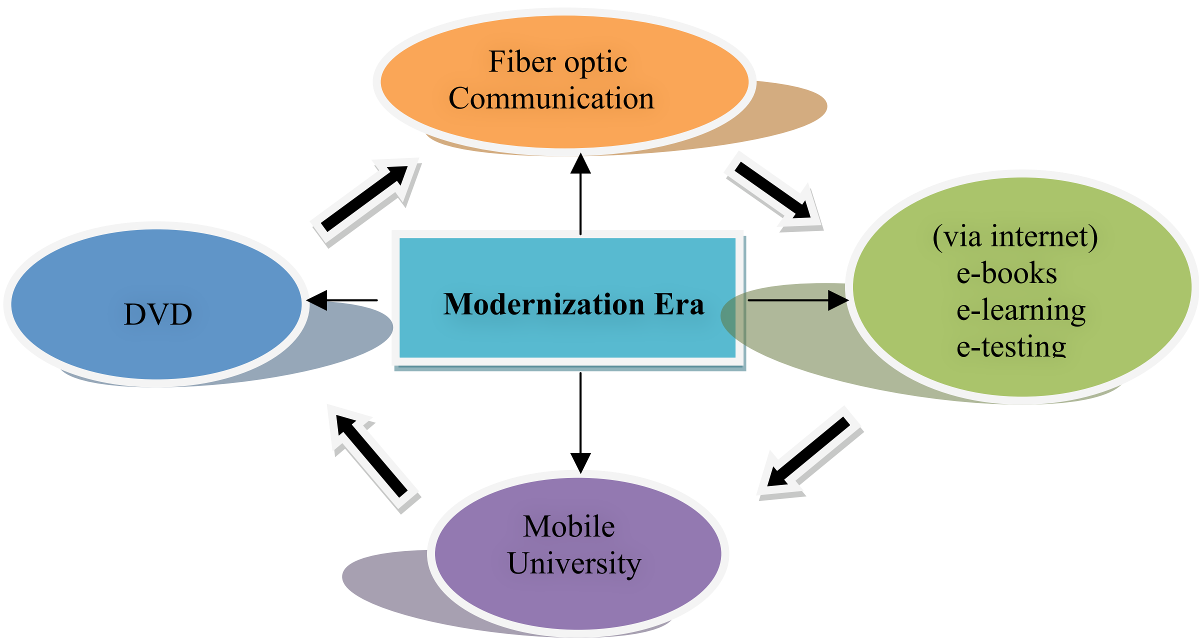
Back in time, Thailand's educational system was straightforward just like a diagram shown above. There were on-campus classrooms; and some universities with large number of students often had to employ the use of CCTVs (Close Circuit Television) to accommodate everyone sitting in such large-sized room, which sometimes fits up to 1000 people. The students who couldn't make it to the classrooms had an option to turn on a radio to listen in real-time and were then able to keep up with other classmates. There was also a tape cassette option which was used to record materials in audio format made available for people to borrow and catch up on what they had missed in class. Clear advantages of the "Classic Era" model were; 1. it was cheap and affordable to everyone. One credit hour in college cost only 18 Baht (50 cents), 2. Even poor students could borrow a tape cassette and always could stay informed of what went on in class, 3. It worked well with such large classes. The disadvantages were also very obvious; 1. The students had to be on time to be able to follow the materials being taught on CCTVs or Live Radio, 2. In bad weather, radio couldn't transmit clear and understandable quality of sound, and 3. There wasn't a two-way communication between teachers and students.

As time passed, Ramkhamhaeng University focused on the use of more advanced technologies to improve its teaching and learning experience; and that can be illustrated in the "Neo-Classic era" diagram shown below;



Looking at this model, we see that instructors taught in class while being broadcasted to a few other classrooms in other provinces. With the help of Thaicom satellite, there effectively were some form of two-way communication between instructors and students in remote areas. The lessons taught this time could be recorded by Video Home System (VHS), and provided another level of comfort for students who were now able to see and listened to what they had missed in class. Problems remained that when weather wasn't so great, satellite signal transmission didn't work so well resulting in unclear images and delay in audio output for up to 3-5 seconds, creating difficulty in the learning process.

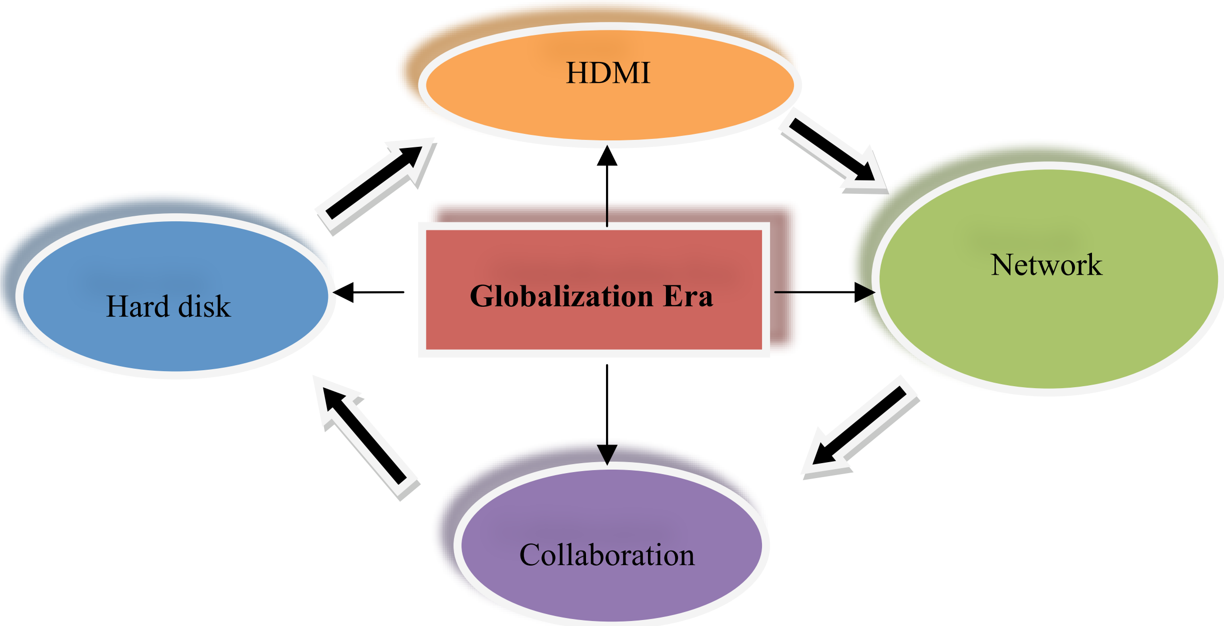
Realizing the problems and with more exposure to and thorough understanding of technology, we took another step towards quality learning; E-university. Shown below indicates a more sophisticated and advanced form of learning offered by Ramkhamhaeng university, and it's being categorized as "Modernization era".



The “Modernization era” is something every one of us can relate to in today’s world. With fiber optic communication which can be considered reliable and very stable, coupled with internet system; students can practically get information from anywhere they are. Concepts of e-books, e-learning, e-testing thus emerged. The world has been made so much smaller by the power of the internet. Real-time broadcasting is now possible, people are now able to participate in any online sessions as well as being able to raise questions and have them answered immediately. DVD, a new form of media storage device, was introduced. Ramkhamhaeng University then went outside the box and achieved another solid milestone by creating “mobile university”. With its clear objective to be able to reach out to people in the suburban/rural areas of Thailand who wish to receive quality education, a luxury coach is equipped with satellite signal receiving capabilities, 39 computers fully loaded with knowledge, and driven all over the country to give needy people a chance to learn. In return, we effectively started a program KM (Knowledge Management). KM offers rural people a chance to learn from our Mobile University service as well as giving them an opportunity to share their local wisdom, know-how about certain things they maybe accustomed to. This ultimately opens up a platform for interactions between rural people, academics, and students; which also promotes understanding among different groups of people, learning from each other, and mutual benefits for all.

Since 2002, the "Mobile University" has succeeded in reaching out to nearly 70 provinces throughout the length and breadth of the country, with a total of more than 90,000 learners joining the project.

Ramkhamhaeng University is well versed and determined to stay ahead when it comes to distributing knowledge to where the need may be, therefore another bold step was taken to put us right where we should be, "Globalization era".



In the Globalization era, state-of-the-art technology is utilized to maximize the gain for both teachers and students. HDMI, (High Definition Multimedia Interface) connector produces clear digital audio, video, and data display; and in addition, it costs less than Fiber optics. With this model, everything is interconnected in a "network". Systems from various universities all over the world are integrated into one network. Information is no longer needed to be put on a cassette, VHS, or a DVD, but instead will be stored and readily available on the main server's hard disk. Students and teachers from anywhere can upload and download class materials as well as any information they wish at any time they'd like. With this setup, easy and effective collaboration between people here in Thailand and those from overseas will result in the most comprehensive way for interaction between people worldwide, true understanding of the world situation, the most effective platform for information exchange, and last but not least equality of opportunity to quality education for all.

Conclusion

Since 1971, Ramkhamhaeng University has employed all the strategies to achieve the founded mission of the University in providing the education for all. Starting from the Classic Era, in order to fit the large size classroom and the available technology during the time period, CCTVs and audio cassette are used. Following with the Neo Classic Era, the VHS tape and satellite broadcasting network are used to expand the covering area of learning and educational opportunity to remote area students. In the Modernization Era, Ramkhamhaeng University has employed the education program along with the modern information technology to set place in the modern world with the e-learning, e-testing, and mobile learning program. At last, Ramkhamhaeng University in the Globalization Era has improving the learning content along with the growth and fast changing of modern day technology, committed to the first and found mission of the university, providing the equal educational opportunity for all.

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A Design for Quality Improvement in Remote Higher Educational Institutions using Technology and Knowledge Management – an Indian Experience

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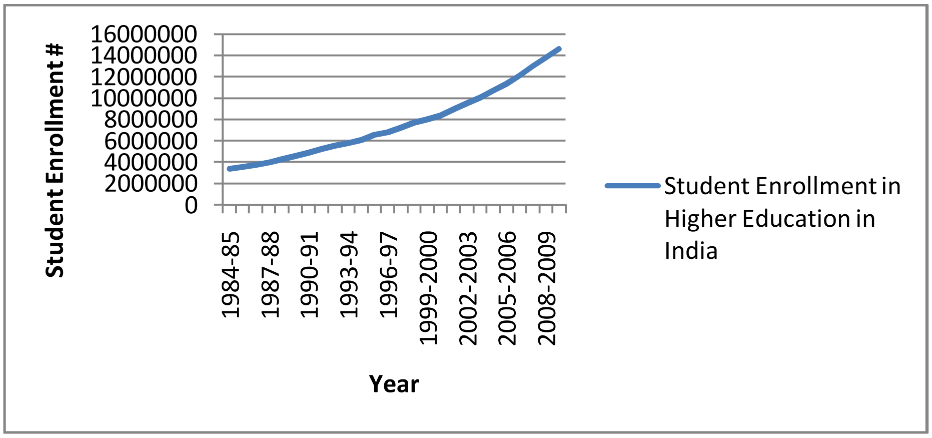
Abstract

The current requirements for learning in developing nations like India are posed with the challenges of quality, quantity and equity. As we have not yet equipped ourselves enough, to cater to these increasing demands, there is an increasing gap in quality between the desired and the actual. This requires a system level solution, with appropriate combination of people, processes and technology. Architecting the solution empowered by technology and accelerated by Knowledge Management (KM) is a key requirement which is the focus of this work. Based on a comprehensive study of the KM best practices across three learning related application domains and deep analysis of the requirements of educational institutions facing these challenges, we present our KM conceptual design and the roadmap towards implementation. We have designed this for a group of engineering institutions located in a remote area which has large demand for quality education but without adequate local expertise to address it, which is the critical challenge of Indian education system today and to a large extent that of the developing world.

1. Introduction

Having seen the correlation between educational qualifications and the economic rewards, there has been a natural upsurge in the aspirations of citizenry of developing nations like India, which has resulted in a nonlinear increase in the enrollment in higher educational institutions. Figure 1 gives the plot based on statistics available in the University Grants Commission Report [1]. While it may be gratifying to see these numbers and its trends and a lot of efforts being taken to significantly improve the Gross Enrollment Ratio (GER), there is a serious concern when we see the quality of education offered. The poor status of the quality in Indian Universities is quantified in another UGC Report [2]. A much more recent survey [3] on the employability of the students from Indian Engineering institutions has reported that less than 18% are employable in the Information Technology (IT) services sector and less than 3% in IT product companies. Though IT employability is not the main goal of an educational institution, these data gives us some basis to validate the subjective opinions of experts in the system, which is also on similar lines. The report also states that the employability of the students decreases logarithmically with the increase in the number of engineering institutions. While increase in GER is important in the growing knowledge era and the economy, it is equally vital to keep up the quality of the system and its outcome. Now that the system has not been planned or implemented adequately enough to this large growth in the learning requirements, there is a challenge to the quality of the number-wise growing educational sector.

Figure 1 – Student Enrollment in Higher Education in India

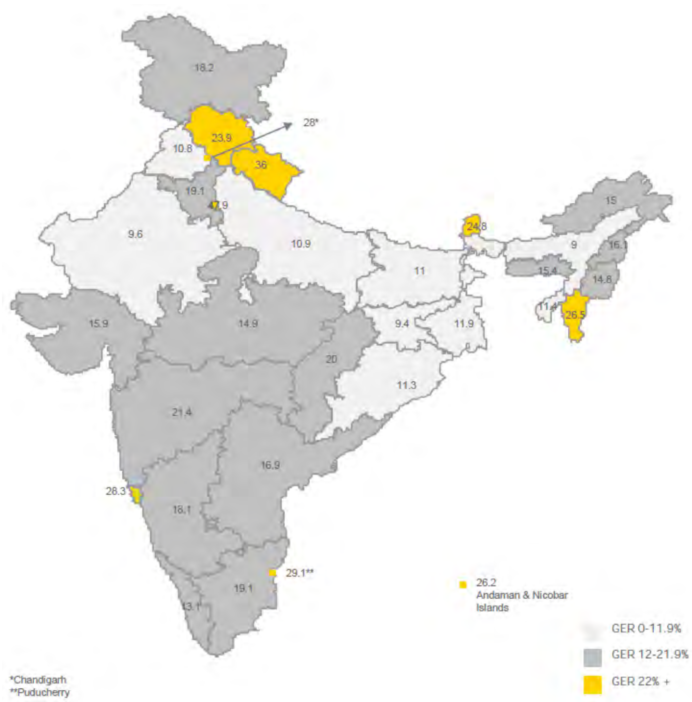


Source: University Grants Commission Report [1]

1.1 Challenges for Quality Higher Education in India

Federation of Indian Chambers of Commerce and Industry (FICCI) Education summit's deliberations on Higher Education in India: 12th Five Year Plan and beyond, have reported[1] [4] the following challenges.

Figure 2 - Gross Enrollment Ratios of Indian States – 2010 [4]



Source: FICCI Higher Education Summit 2012 Report [4]

[1] The data inputs have come from many UGC reports, Ministry of Human Resource Department, further compiled by Ernst and Young at the behest of FICCI and Planning Commission of India.

- Expansion
  - India's GER of 16% is far less than the world average of 27% (2010)
- Equity
  - Wide disparity in GER across states (47.9% in Delhi vs. 9% in Assam)
  - Gross Attendance Ratio (30% in Urban and 11.1% in Rural Areas)
  - Differences across communities and gender
- Excellence
  - 40% and 35% shortage of faculty in state and central universities, respectively
  - 51% of Professor positions lying vacant in central universities
  - National Assessment and Accreditation Council (NAAC) 2010 statistics report 62% of universities and 90% of colleges are either average or below average.
  - The citation impact of publications from India is half the world average.

Our responses to these challenges are presented in this work as follows. Section 2 describes the growing technological reach. Section 3 introduces Learning and Knowledge Management. Section 4 provides our KM conceptual solution. Section 5 describes our roadmap for quality improvement. Section 6 presents further challenges and what we are looking for, Section 7 summarizes this work, Section 8 concludes this paper and Section 9 lists the References.

2. The Technology Environment

Table 1 gives the snapshot of the statistics of Indians using Internet. Given the current penetration and the rate at which it is growing, we can see that the internet platform is opening up huge possibilities.

Table 1

Internet Usage Statistics India 2012			
Description	**Quantity**		**Source**
Population	1205	Million	Internet World Stats
Internet Users	137	Million	Internet World Stats
% of Internet Penetration	11	%	Internet World Stats
% of world users	5.7	%	Internet World Stats
Mobile Subscribers	904	Million	IAMAI & IMRB /TRAI
Mobile Users	78.7	Million	IAMAI & IMRB /TRAI
Age Group 15+	62.6	Million	Comscore
% of Youth (15 to 35 Age) of 15+	75	%	Comscore
% of Yearly Growth	41	%	Comscore

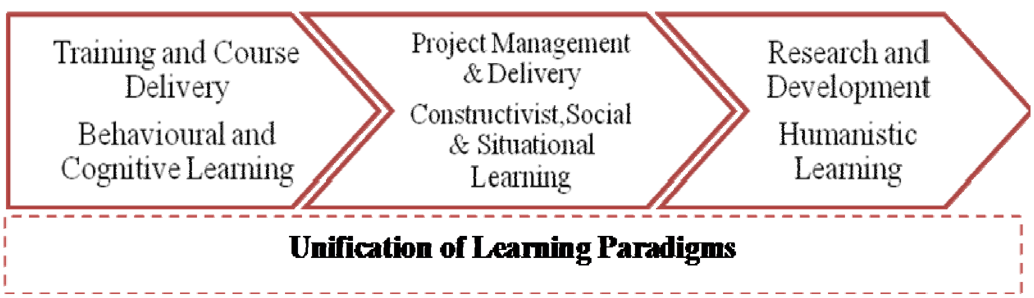
The large percentage of the youth users is noteworthy, when we are looking for new avenues for higher education. These users are agile, technology savvy, willing and are ideal for experimenting with and adopting new learning paradigms.

Even among the employed workforce, a recent survey [8] reports that India today consists of a highly motivated and self-reliant workforce aspiring for appropriate training. Another trend worth noting is that while 79% have taken up classroom training, 58% of people have *also* experienced online training. The Cegos Asia Pacific survey also reports that India is the greatest user of smart phones for learning. This suggests that while classroom training is still preferred, there is a significant scope for usage of technology for learning.

3. Learning and Knowledge Management:

As educational institutions are to systematize learning, we look at Knowledge Management (KM) as an effective accelerator for maximizing learning with the appropriate use of people, processes, structures and technology. The research thesis [9] studies the literature on diverse orientations to learning and arranges the varying learning paradigms to different stages of learning and maps them to appropriate domains whose characteristics matches with each learning stage. In order to address learning comprehensively, this work, structures the major learning paradigms into three phases. Learning which affects the behavior and cognition at the first phase is the main objective of the training and course delivery environment. The next phase focused on constructivism, social and situationalism is predominant in the project management and delivery environment. Humanistic Learning, which is predominant in the Research and Development environment, happens at the third phase. These orientations of learning appear diverse if perceived in isolation. In the effort to systematically place them with respect to the natural evolution of the learning process in the learner, each of them get placed appropriately in different phases or stages, depending mainly on the objective and the current position of the learner. Thus the underlying unity in the diverse learning paradigms has been illustrated in this work.

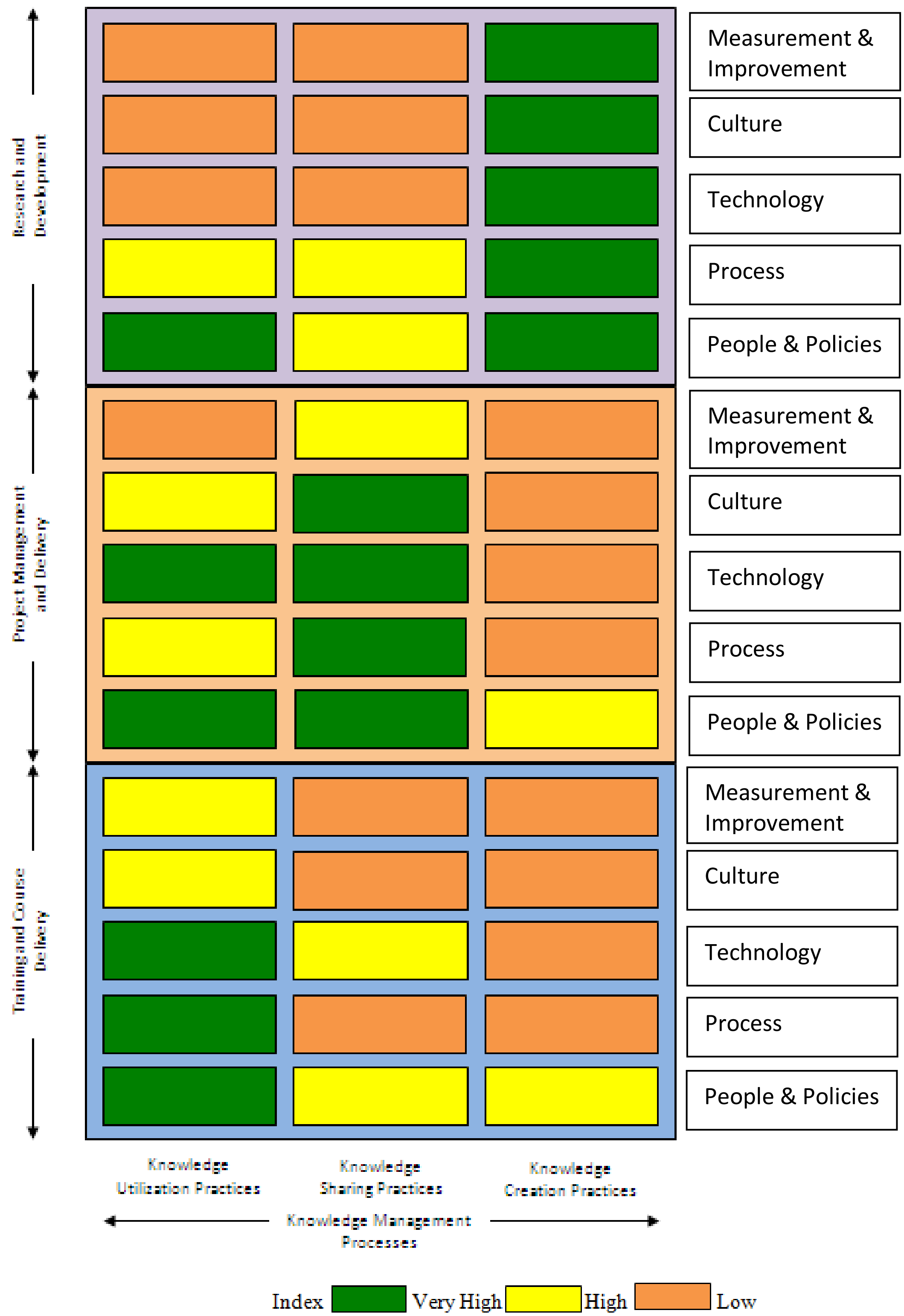
Figure 3 Learning Unified



Extensive analysis (surveys, focus group study, content analysis and in-depth interviews) of the issues in the current learning ecosystem (University, affiliated engineering colleges and educational media organizations) resulted in pointing out the strong presence of KM drivers and low to moderate presence of enabling conditions. Hence as the next logical step, the KM best practices in each of the three environments were studied using case study, grounded theory and secondary research data.

The three environments / KM application domains studied in this work and the findings are: Educational Media catering to Training and Course delivery is strong for Knowledge Capture and Dissemination; IT Services Industry catering to Project Management and delivery is strong for Knowledge Sharing and Application; and R and D Institutions catering to Innovation and Research is strong for Knowledge Creation and Utilization. The study also resulted in yielding out the KM best practices (Figure 4) with respect to three major life cycle processes of Knowledge Utilization, Knowledge Sharing and Knowledge Creation.

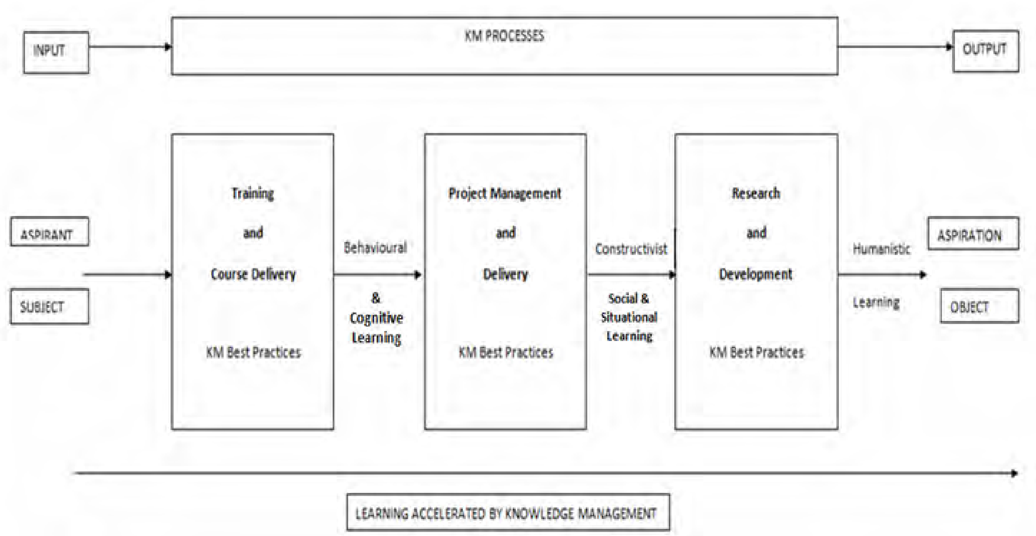
Figure 4 - KM best practices



4. Solution Design

Integration of the KM best practices in these three application domains and mapping them with the appropriate learning stage is the foundation on which this design has been built as is shown in Figure 5.

Figure 5 – Conceptual Design



Accordingly we plan to make use of the best practices detailed in [9], a few of which are captured in Table 2; of knowledge capture and dissemination from various educational initiatives; Knowledge Sharing from IT Industry; Knowledge Creation from Research and Development institutions. We need all these KM lifecycle processes and best practices for building and sustaining a holistic learning environment in educational institutions.

Table 2 – Knowledge Management Best Practices

Knowledge Dissemination Practices From Educational Media	*Knowledge Sharing Practices From IT service Industry*	*Knowledge Creation Practices From R&D Organizations*
Prominent Subject Matter Experts Identification facilitates easy high quality content generation and distribution	Committed leadership to drive Knowledge Sharing initiatives. Cleary defined KM roles and structures	Thought Leadership, driven by intellectual pursuit and peer recognition – recognized by publications, awards and other Intellectual Property Rights
Wide variety of distribution mechanisms empowered by technology for access	Leadership demonstration of commitment & competence, open communication, conversations in common language	Policies and practices to partner with premium institutions and colleagues across regions
Servers with mirror sites and advanced search options for structured and unstructured	Distributed model of creating knowledge – crowd sourcing, encouragement to seek and	Periodic informal team meetings and variety of brainstorming formats

knowledge	share, transparency	
Availability of tools to do easy content / document management and distribution of knowledge	KM seen as potential enabler of every function of the organization	Allocation of adequate funds for long term new research domains, that does not warrant immediate results
Relatively high centralization enables easy monitoring, measurement, control and continual improvement	Encouragement for collaboration, organizational KM campaigns – awareness, promotional activities and recognition	Sponsorship and encouragement for higher studies, conferences / seminars, sabbaticals, visits to other R&D organizations etc...
Open and free content	Heavy adoption of interactive technologies including web2.0, pulling together to achieve shared objectives	High degree of flexibility, support for learning from mistakes
Ensuring quality of content	Periodic analysis and reporting of trends	Culture facilitating innovation and supporting co-creation.

5. Roadmap for Implementation

Having arrived at the design, in order to realize KM effectiveness, there is a need for Knowledge Management System (KMS) road map. Towards this, a prescriptive framework, derived from the existing descriptive frameworks (APO 2009[10], ISO 9001:2008[11]), and the results and inferences from the study [9], are presented as follows:

It starts with core People (Leadership), specifying the Policies. In accordance with the directions specified in the Policy, the Processes and supporting Procedures and Guidelines have to be defined. The necessary Technology has to be either acquired or developed. Training has to be provided to the entire Team and the users to ensure that all the stakeholders understand all aspects of the KMS including the use of Technology. Continuous Practice of this results in internalization of the KM Practice as KM Culture. As with any quality process, the effectiveness of the KMPs has to be measured by using appropriate Metrics. The measurements go as feedback to the periodic Knowledge Management Review Meeting for necessary corrective / preventive actions, review of the Policies and Objectives for Continual Improvement. As KMPs sustain their momentum in this stage and beyond, the performance of the KMS results in the seamless achievement of the KMSs objective of bringing the learner and his object of learning together.

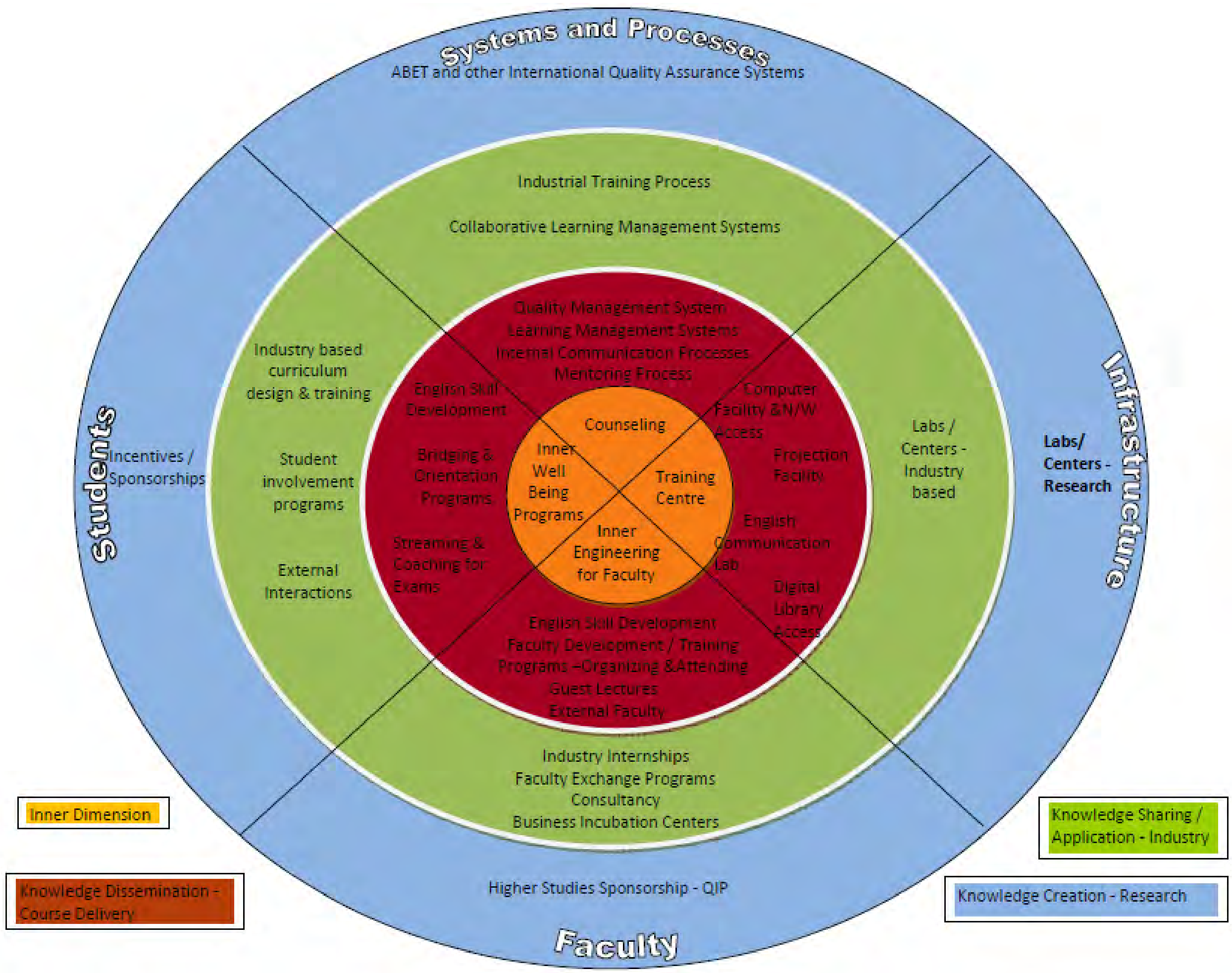
5.1 Quality Improvement Plan – A Specific Case

In this section, we present the plan for the initial phase of interventions for improving academic quality of a group of engineering institutions, which form our immediate focus. The group has five engineering colleges with a total of around 7300 students and 484 faculty members, in the Salem – Tiruchengode region of Tamilnadu, India. One campus is near Salem, another near Tiruchengode and the remaining three are located on the road from Salem to Tiruchengode. The students and faculty are largely from Namakkal, Salem districts of Tamilnadu. These colleges are all affiliated to Anna University and together offer 7 undergraduate engineering programs, 5 postgraduate engineering programs and Masters Programs in Business Administration and Computer Applications.

Our objectives have been to continually enhance the learning ambience in each of the following dimensions:

- Inner (Dimension) Way / Isha Yoga for Inner well being [16]
- Course Delivery / Knowledge Dissemination
- Industry Practices / Knowledge Sharing and Application
- Research and Development / Knowledge Creation

Figure 6 – Quality Improvement Plan



To meet the Quality Objectives for each of the four stated domains, quality improvement processes have been defined for each of the following aspects and are being continually improved:

a. Faculty
b. Students
c. Systems and Processes
d. Infrastructure

Figure 6 highlights variety of phase one interventions planned (from center- outwards) spanning the aspects defined above. These have been arrived after a deep study of the existing status, the environment, the availability of resources, and the objectives of the various stakeholders of the institution. It should also be pointed out that there are 520 engineering colleges affiliated to Anna University of Tamilnadu, India following the same curriculum and the examination system. The design of the KM based learning solution presented in this paper, can easily find applications in any of them and the broader framework can be applied to any learning based organization. However the specifics (proportions and combinations) of interventions will have to be customized to each institution depending on its current state, its environment and its objectives.

5.2 Technology Based Interventions

As technology forms a special focus of this paper, we would like to present further details on the same. As presented in Section 2, there is a prevailing technology infrastructure, which provides us the opportunity to roll out our KM dissemination and sharing solutions. In the institution where we have planned the implementation, for example, we have a phased availability of tablet computers to all students, wifi enabled campus and adequate multimedia servers. We have identified a service provider who has consolidated, categorized much of the educational video content available from MIT [12], NPTEL [13], Khan Academy [14] etc… The same service provider also registers the students and pushes the content to a variety of end devices available with the students. All these above services are for free to the institution and the students. The service provider gets his revenue from the usage statistics of the students. These statistics about students with various profiles of learning are passed on to their potential employers, who provide for the income of this service provider. The active student also gets an employment avenue, while he benefits from technology based learning facilitated by this service provider. There are also service providers who provide content for improving employability, who will also collect and use statistics of the registered students for the same purpose. In addition there are online service providers who administer employability and other aptitude tests, to test and measure the skill sets of the students. The results could be used to do SWOT analysis, to offer bridging courses, and to offer career guidance.

While the service just described will only satisfy large scale dissemination of content from one to many, it may not serve for much interactivity, networking, collaboration, sharing and problem solving. This would require a different level of a knowledge sharing platform, which would allow for identifying the right set of people, to see posts on a certain topic, identify domain experts, connect to them, post queries and have conversations. This same platform can also be used for posting a problem, so that the entire audience (crowd) will come with innovative solutions for the same. In this way the technology can provide the platform for knowledge sharing and creation. We have also identified a tool [15] which has been successfully used in the IT service industry for a similar purpose of leveraging the wisdom of the experts across different geographical locations and the crowd for solving business problems. We have planned to use this tool for connecting experts in the academia and the industry with students and faculty of the target educational institutions for special training, project work and for facilitating the people connections for joint research. The same tool can be used for program managing our interventions across multiple campuses.

6. Challenges and Future Work:

While we have reasonably addressed the technology aspects of the solution, challenges remain in the process and people front. The standard processes with respect to learning and KM require customizations to the specific environment. Hence the time required for understanding the learning and KM requirement and tuning our processes (including pedagogical changes that will be required) and technology, is the next step. People aspect of the solution, however, remains the biggest and the most critical challenge in this endeavor. As our objective is to take the faculty, system and the students together with us in this exercise, we have taken a multipronged approach involving all stakeholders. Given the technology savvy and agile nature of the students, it should find easy adoption with them. Convincing the top leadership on the benefits of the solution, should get the necessary support for causing the changes in the system. There is a significant new requirement in the transformation of the role of faculty. A large percentage of faculty time and effort has been conventionally, on knowledge delivery. Now that much of it, over a period of time (initial overheads would be there), could be handled by technology on/off line, the faculty will be required to take up multiple new roles. At the lowest level of intervention, the faculty might have to just facilitate the learning. He might have to then pose innovative problems and methods of solving them. He might have to trigger curiosity in the students and inspire them for their self- learning using the existing learning resources. To initiate, orient, train and systematize such transformation in the faculty require more subtle work, which is the challenge that we are looking forward to handle.

7. Summary

This work started with a deep analysis of the requirements of higher education in India, identified its critical challenges and presented the changing technology landscape which opens up unprecedented opportunities to meet out the challenges. In the search for solutions to variety of learning requirements, we unified the existing learning paradigms - hitherto seen as diverse, mapped the main KM lifecycle processes with each stage of learning, integrated the KM best practices and applied it to develop a quality improvement plan for a typical higher education institution - facing these challenges. An implementation roadmap that has appropriate people, processes and technology based solutions, has been laid out. We presented details of technology based interventions, further challenges and our broad approaches in resolving them, and concluded with the critical requirement of pedagogical changes and faculty role transformations required in this context. We look forward for learning (including its application) various methods of catalyzing this phenomenon in institutions of higher learning.

8. Conclusion

Technology has connected us like never before, and is going to be increasingly so in the future. Any student in any corner of the world will soon have the opportunity to listen, watch and may be - take up a course from the best of the faculty of the world. Technology however has its limitations. What is designed for one type of an educational system from where the content is mainly generated, may not as such suit the requirements of the rest of the world, where there is a very large audience. Large scale customizations are needed to suit different types and stages of the educational systems of the world. This will require adoption of conscious KM program in all its key life cycle processes of creation, sharing and utilization. Such processes have to be followed by all the entities involved; benevolent institutions generating the content, service providers and users. It does not matter how much level of sophistication we reach at, given that each student is unique, there is no easy way for technology and processes alone to satisfy the learning requirement of a learner effectively without human intervention. A faculty would always be required to do that for varieties of students. He will be required to kindle the curiosity, show the way, help solve the problems, and inspire the learner towards the cherished objectives. This role requires continual adaptation based on the state of the student, learning objective, technology and that of the system. As in computer science, this non determinism is where our most critical challenges remain and will keep us driving this continual process.

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Virtual Support Services for Educators (VSSE)

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Abstract
Integration and Institutionalization of educational technology chiefly depend on the continually trained educators. Most teachers left to tinker with technology all alone will soon abandon it when there is a fault. This invariably makes the process of transferring to technologically enabled class not to progress. One of the key solutions is 24/7 consistent support accessible to all levels of educators. By creating a support community purely for teachers using Internet technology and interfaced with a call center, adoption and adaptation of technology can be made seamless, user friendly and cost efficient.

1. Introduction

Support Center is the key to evolving the use of technology in all sectors that we can imagine. The gadgets at home soon come to naught without good "live" technical support services and appropriate manuals to apply it. Technology manufacturers go all the way to establish user manuals, technical manuals and create educational videos channeled towards the customers for effective usage of their products. Apart from the manuals, a customer care center is opened for customers to ask questions, make complaints and receive instant feedback on whatever issue the products have.

Educational technology is the practice of using ICT to facilitate learning and improve performance by applying appropriate technological processes and resources Richey [1]. Hence, the product and service delivery viewpoint can also be adapted to technology use in education. For instance, if we view educational technology as a product and educators as customers, the company producing an educational technology product, will be accountable to present support for the product in the most lucid and usable way for the customer to easily use. However, this cannot be said to be true in majority of the cases of technology deployment in schools either in developed countries like the United States or emerging economies like Nigeria. In fact, most of the times educators are left to figure it out themselves how a technology deployed for them works.

This is the genesis of the problems educational technology has in schools both in the early years up until the present especially in the developing world and even in several places of the advanced countries. Teachers may not use technology in exactly the same fashion as Duhaney [2] reported; however, there should be minimally acceptable standards or state mandated standards for the use of educational technology.

According to the UNESCO report [3] the key individuals in helping students develop those capabilities i.e. use of technology, are the classroom teachers. Pedro [4] noted the quality of the educational system cannot be higher than the quality of its teaching body. The teacher is responsible for establishing the classroom environment and preparing the learning opportunities that facilitate students' use of technology to learn, and communicate. Consequently, it is critical that all classroom teachers are prepared to provide their students with these opportunities. Teachers are learners too, according to Koehler [5] who presented three ways to which technology can be integrated by teachers. He focused on learning about technology, learning about design and learning about learning. But with the limited time a teacher has, a system has to be in place to support adaptation. A community approach is a flexible pattern wherein the teachers can learn not just from workshops and symposia but from peer to peer. Such an approach would enable the teachers to continue their professional development and to support their students. This makes application possible while they take classes' week in week out.

Driven by the decision to empower our community to expand the use of technology, the Yaba College of Technology UNESCO/UNEVOC Center for Research and Sustainable Development is currently seeking fund from the Internet Society through their community grant initiative to setup the Datacenter for this project to commence. The project is in conjunction with a local IT organization who will supply the technical expertise. Initial deployment would be in the College's 8 faculties and a high school district (constituting about over 20 schools) in Lagos, Nigeria. Expansion can then take place after the initial rollout.

It is not impossible to bridge the gap that exists in educational technology adoption today. The solutions perhaps abound more on paper than in reality. Modeling a service delivery system can be the Holy Grail to encourage more educators to embrace technology use for classes both within and outside the classroom. Using the model of the contact service and technical support of business companies will make technology use seamless for teachers anywhere.

2. The Digital Divide still exist

Thorburn [6], made reference to Leggett & Persichitte [7] that since the 1950s (post World War II era) barriers to technology use has been around. The following were highlighted as the barriers to the use of picture film in classrooms:

- Finding the right match between the film resources and the curriculum;
- Inaccessibility of equipment;
- Cost of films and upkeep; and,
- Lack of teacher skills in using the equipment and film.

As at 2004 the following were identified barriers to technology usage:

- Lack of time;

- Lack of access;
- Lack of resources;
- Lack of expertise; and,
- Lack of support (Butler and Sellbom, [8]; Leggett & Persichitte, [7]; Rogers, [9]).

This was also supported by Tien and Luff [10] who found that the relationship between the teacher and the technical support person could be a barrier. Goldenberg and Outsen [11] while completing a study of online professional development discovered that teachers did not want to correspond via email because they did not feel comfortable in that environment. Teachers felt they did not have the skills nor did they possess knowledge of all the nuances that are associated with that medium. A follow-up on technology barriers for teachers in Spencer's blog [12], also outlined the same pattern of thinking by teachers using technology in the classroom. Moser [13] quipped that in the teaching phase, systematic support that goes beyond troubleshooting of IT issues is rarely offered. Support for reflection and evaluation for a course that has been taught are even scarcer.

Consistently, lack of support showed up as one of the main challenges outlined. Responses to Spencer [12] suggests that somehow effective support is simply what is lacking for the leader that fails to present the right policy or the teacher that fears using technology for reasons mostly time based.

Moser used a classification of teachers' adoption of technology into five categories to illustrate his point. He found out that only the first level of users i.e. the Innovators will continually test out technologies because they are intrinsically motivated. Other four perspectives adopt mostly from a school wide initiative and they are basically imitators; a situation of which if there is a setback in the level ahead, the other levels simply abandon using technology [13]. Zhu [14] also, described ICT adoption by teachers in a role based format. Originally from Grasha [15], teachers various roles include:

- Expert: "Facts, concepts, and principles are the most important things that students can acquire."
- Formal authority: "I set high standards in this class."
- Personal model: "What I say and do models appropriate ways for students to think about content issues."
- Facilitator: "Small group discussions are employed to help students develop their ability to think critically."
- Delegator: "Students in this course engage in self-initiated, self-directed learning experiences."

The roles are flat indicators of teachers' perspectives which transform to technology use as well. A teacher according to Zhu [14] has at list two major roles but exhibit each of them at one time or the other. The implication is that depending on the role the teacher display, it is a determinant of how technology is adopted in such classes. Positive transformation then implies better understanding of this underlying bases and consistent support to change when the need arises. A teacher wouldn't do this all alone.

Heick [16] mentioned the rapid rate of change of technology, which makes a large set of teachers uncomfortable adopting it in the long haul because of the learning curve it requires. Educators prefer what they can learn and make use for several years without really changing the concept. Technology's dynamism makes this a bit difficult as new and better technology replace old ones in less than two years (Moore's Law in computing). While this factor is beyond the scope of the educator, they can as much be prepared to blend with changes provided there is support.

Invariably, a digital divide exist in classes due to these adoption levels of technology by teachers. The margin of competence keeps widening between the innovators and the non innovators. A consistent support mechanism is therefore needed to empower the non innovators to abate the divide that presently exist. A leveraging factor is support for all towards technology in the classroom.

According to Walsh [17], most school's ICTs budgets don't provide for professional development and support services. This is also agreed by Moser [13]. Such a system of deployment is a natural killer of any ICT initiative as teachers are not Information Technology specialist by default. A service delivery model [18] needs to be created that caters for after deployment services. There has to be an ongoing theme of professional development and support for technology in education to be well established. Such a program is for both teachers and school leaders who take decisions.

Moser [13] concluded that a successful program to support educational technology encompasses a well-rehearsed set of scalable support offerings, customized consulting, and fostering a community involving various faculty and various support groups.

3. The VSSE Model

A descriptive analysis of the problem has therefore provisioned two pathways to look in solving the problem. Basically, technology can be problematic in one of two ways:

- User's lack of understanding of the technology
- Equipment fault or breakdown

A workflow is created to resolve this. For the initial problem, the educator only needs to do one of two things search the support site or place a call to the support hotline. However, it would be encouraged that educators register on the network and from the information that were collected, a set of toolkits that is customized according to response is provided. An educator would be able to progress through technology if he/she follows the recommendation of the support site after registration. Also, the kind of gadgets that is been used would have been known before hand for a registered user and several tailored solution would have been sent to the inbox. Since it is not always the case, the support center is prepared to walk the caller through any issue he/she presently has in using the technology in his/her premise. Some issues go beyond just information to use a gadget but a recommended professional development for the user. The support center will make available access to focused professional development for the user to quickly use and go ahead with the class. Since we will be building on layers of volunteers amidst the teachers, opportunities for peer learning which includes mentoring will be provisioned as we will identify educators that are already well-informed and link them up with upcoming educators.

In the case of a fault, routine information will be collected. A simple SLA will be agreed for resolutions to such. The support center will be in partnership with technology companies too and depending on the state of the equipment, appropriate solutions will be provisioned. It is important that schools' are encouraged to be part of the community of the center in order for detail of their technologies in use to be known before any potential fault; this will relatively accelerate resolutions whenever any breakdown occurs. An interesting aspect of the problem is geography. A simple question can go thus; how will a faulty equipment picked up from Yola be rectified in Lagos, one thousand three hundred and forty two kilometers (1342km) away? That is the reason for this solution. As the community expands, several locations will be represented and solutions for physical problems can be getting closer. An example of a community solving problem was the one explained by Joi Ito [20] on how by community effort via the Internet, residents across the Tsunami affected areas were assisted to overcome the radiation epidemic. Through the community he fostered, they were able to measure and isolate incidences faster and widely more than the government agencies could accomplish. Interestingly, help may be some few kilometers or even meters away but since there is no platform to access that, opportunities are missed. Efforts will therefore be intensified by the center to site technical shops, technology groups around areas that networks exist to expand options for quick resolutions.

The solution model being proposed to provide the support services is advancing on the concept used in the consumer products industry and these are:

- The Customer Care model, and
- The Technical Support Model

Both are almost similar expect that the first is informational while the second is technical. The VSSE model is a fusion of the two models for support services to educators. Below are the attributes of the support services:

- It is available
- It is simple
- It is community-driven
- It is essentially collaborative
- It is flexible
- It is professional

The support services have in effect the following structures:

a. Technical Requirement

- Call Center Technology: this is setup to handle voice calls. It is important in a place like Nigeria where the Internet penetration is not as strong as the telephony penetration. With this, communication for the educator will be unbridled and solutions can be sought easily.
- Resource Center which includes Datacenter, Web Presence, social network and community of educators (learners): the aim of the project is engineer a virtual community of support that will continue to expand. The initial steps and mercenary to facilitate that is the resource center.

b. Human Resource

- Core Staff: this people will manage the daily responsibility of the center. This includes technical staffs, call center agents and the administrative unit.
- Volunteers: a community of mutually dependent people will continue to expand the use of technology. The key concept is to empower educators by educators through peer learning.

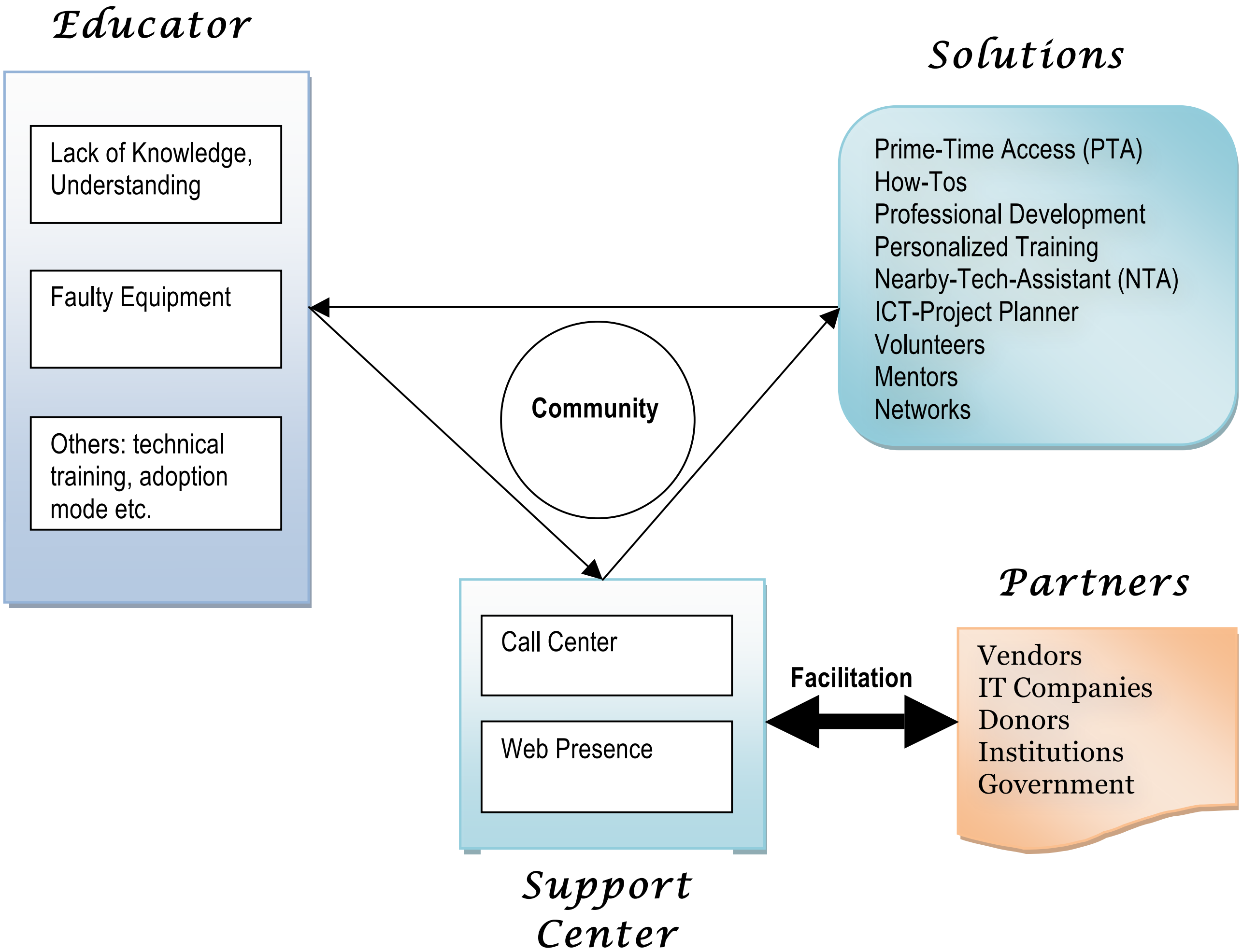

Figure 1 – Schematic of VSSE basic components (not exhaustive)

VSSE is facilitated through

a. Open Technology: The model mitigates cost through the use of open source software most of which have been proven and are used even by large commercial enterprises. Some of them are Asterisk, GoogleApps, Joomla etc.
b. Grants: In the first year, it will start with grants to pull resources together, a network will be encouraged amidst schools and an annual maintenance fee will be required per school.
c. Charges: All virtual consultation will be free as long a school is on the network. Individual teacher calls will attract a rate. Subsidized rates will be used in cases of on physical support which includes handling/transport and replacements. A school on the network is exempted from paying call charges.
d. Partnership: Partnerships are created with vendors and remote technical companies for rebates on repairs from educators and to accelerate response time.
e. The Internet: the word virtual is simply dependent on the Internet. Communication is first on the Internet and every technology used is Internet enabled and enhanced. We hope this will help expand the reach, richness and usage of the Internet amidst educators

f. <u>Advisory Board</u>: the Internet itself sustains on the various advisory boards that exist to improve and enhance it. VSSE will have both individual and institutional advisers which will continually aid its consistency, focus and expansion.

The VSSE model components depicted in figure 1 and explained above is a concept that is expected to evolve sustainably.

4. The Importance of the Concept

Virtual Support Services for Educators is designed to bridge educators' adoption of technology and allay any fears of technology be it technical or otherwise. This will make educators to focus on educating while getting support for the means/media they use.
It is being projected that by offering this, teachers in the middle of adoption will be encouraged to move up and use technology for their classes.
An integrated community (figure 1) is a key component of this model. The following are what community affords us:

- A consistent language
- Experience
- Encouragement
- Collaboration
- Assistance
- Empowerment
- Lowering total cost of ownership
- Low cost of adoption
- No consultation fees

Some of the other areas the model will be effective and particularly draw strength from include:

- Engage in continual need analysis
- Provide a well-rehearsed supply of scalable services that reflect the priorities and skills of the individual support groups
- Implement a solid and efficient process for consulting with individual faculty
- Get involved with a number of larger projects that foster overarching collaboration
- Conduct multifaceted evaluation activities

VSSE is uniquely positioned to provide those services because it is absolutely support based. To prevent the common low budget challenge it is implemented in a community and it can be paid for collectively.

5. Let the community begin

As it has been well stated through research based in educational psychology, learning is done more in networks i.e. a community than singly. Kozma [19] on the knowledge ladder talked instinctively on the need for a community approach to knowledge creation which is the summit of the ladder he depicted. The virtual support services model is an opportunity to start to concretize such ideas and realize the vision of the 21st century information for all. The institutions either K-12 or Higher Education are the building blocks of the knowledge strata hence an information community which stand as a pivot for unbridled knowledge flow using technology is what is akin to actualizing the visions of the Information Age.

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The MIT LINC 2013 Conference

Parallel Presentations

Session #10
The Critical Role of Teacher in Successful Technology-Enabled Education

- "A Constructivist Model of Teacher Training for eLearning in Knowledge Based Connected Society: I-CONSENT Initiative" presented by Martand Deshmukh and Veena Deshmukh (India)
- "Training of Polytechnic Teachers through Blended Technologies: A-VIEW and MOODLE Web Based Technologies in the Western Zone of India" presented by R. K. Dixit
- "Integration of Technology Enabled Education in Learning: a Comparative Study of the Influence of Learning Standards in the U.S., Japan, Singapore, and Finland" presented by Kanji Uchino (U.S. and Japan)
- "Reducing Teacher Resistance to Change and Innovations" presented by Hayal Köksal (Turkey)
- "Education for All Children: Countering the Challenges through Teacher Education" presented by Preeti Vivek Mishra (India)

A Constructivist Model of Teacher Training for e Learning in Knowledge Based Connected Society: I-CONSENT Initiative

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Abstract

This paper presents Tech-MODE teacher education program developed at I-CONSENT, India, to prepare teachers for e learning, using situated learning design and constructivist pedagogy. It is designed, developed, delivered, and supported by a group of thirty five educators from eight institutions/universities on the ePASS as an OFDL program with the support of COL for QE4A. A critic of the model is given, in the context of pedagogical principles, developmental objectives, innovative strategies and the experiences gained and insights developed during pilot run of the program for two years.

I-CONSENT

Indian Consortium for Educational Transformation **(I-CONSENT),** a non govt. nonprofit organization, was established in 2005, as a platform to work collectively for educational transformation-through Technology Mediated Open and Distance Education (Tech-MODE), for development through "quality education for all (QE4A)", with the initiative of Ram Takwale, former Vice-Chancellor of IGNOU, Mohan Menon, Education Specialist; Commonwealth of Learning (COL), Martand Deshmukh, Senior Education Consultant from Mumbai, and about 50 education experts from various institutions like six state universities, the state open university-YCMOU; Non-Governmental Organizations (NGOs) like Indian Institute of Education (IIE), Homi Bhabha Center for Science Education (HBCSE):Tata Institute of Fundamental Research (TIFR); Corporate Bodies like Maharashtra Knowledge Corporation Ltd. (MKCL) ; State organizations like

* The senior author was Director, Distance Education Program of District Primary Education Program (converted in Sarva Shiksha Abhiyan), sponsored by the World Bank, an initiative of Govt. of India for Universalization of Elementary Education in the country. He wants to gratefully acknowledge the support of Commonwealth of Learning (COL) in developing B.Ed. (e Education) program, particularly support of Sir John Daniel, the CEO of COL, and contribution of the colleagues from I-CONSENT, Prof Takwale Ram, Former Vice Chancellor, IGNOU and Chairman, I-CONSENT and Prof Som Naidu, CSU, Australia.

Marathi Vidnyan Parishad; and experts from the national agencies like NAAC, NCTE etc, sharing common concerns about Indian education and came out with a co-operative, collaborative and consortium approach to educational issues like QE4A.

With the strong belief that teacher is pivotal to any change in the field of education, one of the initial thrust areas for I-CONSENT activities was teacher education and the first program was development of on line, Tech-MODE degree course to prepare teachers for e learning viz. B.Ed. (e Education) i.e. Bachelor of Education - e Education, with an innovative constructivist pedagogical model.

Commonwealth of Learning (COL) appreciated the concept of this consortium and supported the programs for educational transformation, initiated by I-CONSENT.

Social and Educational Transformation

The world is fast transforming in to a large global connected community with ever-increasing impact of information and communication technology (ICT). Education, as an accepted tool of social change and reconstruction, is in the center of this accelerated process of social and cultural change. It's a total transformation with new life styles, new learning needs and processes, new skills and newer educational practices to imbibe those skills - relevant and useful to the Net Gen.

This has changed the whole perspective of education. This has entrusted the role of information seeker and knowledge creator to the learner. Seeking information and learning to use various resources to generate new knowledge and use it productively, has become a goal for the learner. Transmitting knowledge is no more a valid objective for a teacher. Teacher's role in these processes is also changed from a dominating controlling authority to a facilitating support and a reliable partner in learning. Learners' autonomy is of prime importance. It is the learner who decides what, when, and how of learning.

Issue of QE4A

In India, despite the committed policies and all out efforts of the subsequent governments for more than half a century of independence, the cherished goal of providing quality education for all and achieving 100 % literacy in Indian continent, remained elusive, mainly due to problem of large numbers. Huge population, limited resources, low literacy rate with a great disparity in literacy across the states, male-female, rural-urban divides during last 60 years, made the issue of "education for all", more complex and complicated.

It is the teachers who will have to realize this goal. But is the huge contingent of our teachers, trained in and armed with only conventional teaching techniques, capable of facing the challenges of technology? It's a problem of number-a very large number. Training and re-training of such a large number of teachers, is a Herculean task at any given time. In addition, their periodic re-training to enable them to face the challenges of fast changing new emerging society, successfully, in any meaningful time frame, is practically impossible. The present and forthcoming challenges of teacher education necessitate the development of the ICT based teacher education program.

Table 1.
Number game of schooling in India [1]*

Level of Schooling	No. of schools	No. of Students	No of Teachers
Primary	748547	135316946	2100462
Upper Primary	447600	62056450	1887343
Secondary	128370	31779027	1244515

*2010-11 figures

This was the rationale that prompted us to develop Bachelor of e-Education degree program.

B.ED. (e-Education) program: Context and Goals

This program is designed as a new paradigm program suitable for a connected society in which learning-working–developing is integrated. It demonstrates how constructivist pedagogy and situated learning designs can best be used to empower teachers to manage the development centric educational system and achieve developmental objectives through e-learning. It also shows the why, what and how of a consortium approach in large scale training programs of professionals in developing countries. It can be seen from the program, how available technologies can be used to find out various ways to provide a continuous support to the teachers in the making.

Goals:

The goals of the B Ed. (e-Education) programs are:

1. To develop L3 (Life-Long-Learning) teaching community for e-learning in a connected society.
2. To enable teachers to become reflective professionals with development of their competencies, capabilities and skills that enable them to play multiple roles in teaching, learning, working, developing and transforming together.

The specific objectives of the e B.Ed. program are:

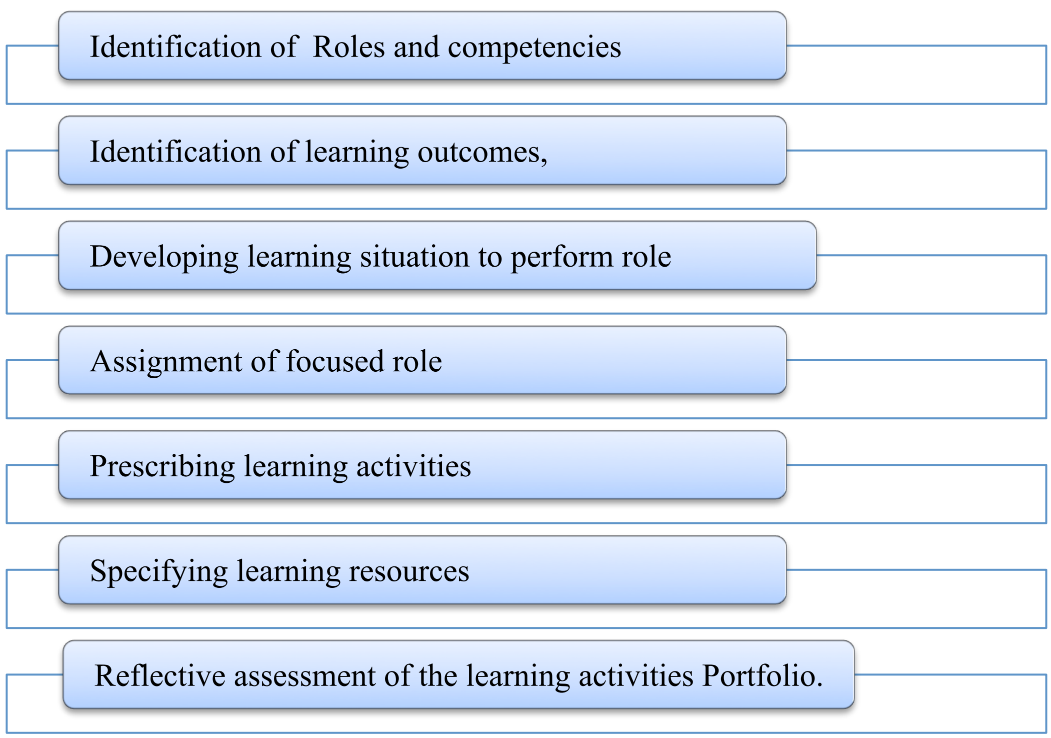
1. To prepare teachers as reflective practitioners for technology enhanced learning and to play various roles in futuristic networked learning environment.
2. To promote innovativeness, creativity, and leadership qualities in teachers in the context of e-education and enable them to cultivate these qualities amongst students.
3. To develop collaborative-cooperative learning skills in teachers
4. To enable teachers to identify and use community resources as educational inputs for learning and developing.
5. To enable professional teachers to undertake action research and to use and adopt innovative practices for development.

Constructivist Model

In India, constructivist pedagogy is accepted for framing the latest National Curriculum Framework (NCF, 2005) and accordingly, the nationwide school curriculum is restructured, text books written and annual examination is replaced by the continuous comprehensive evaluation (CCE). Therefore, this program is based on the basic tenets of constructivist pedagogy like learner centered activity based courses, competency based rather than knowledge based objectives, contextual learning through situated learning design, scaffolding, learning activities and self study, reflective thinking, cooperative learning and collaborative working, and other pedagogical principles such as role based performance for problem solving , concept based rather than content based courses and online networked learning.

Courses with developmental objectives and socially useful productive work (SUPW) for self and community development, as well as, integrated continuous comprehensive evaluation (CCE) with portfolio assessment without course end examination, is a special feature of the program.

Figure No. 1



Scenario Based Learning

This program is based on the "future scenario based situated learning and situated development" model [2].The situates in this program are the classroom, school and community around the school. Study of the learner is based on the scaffolds provided in the scenario and tasks assigned - various activities and assignments to be completed for promoting competencies and capabilities required for him / her to play various roles a teacher has to carry out. The courses are linked with various settings of technology access found in different schools, with excellent to poor facilities of ICT

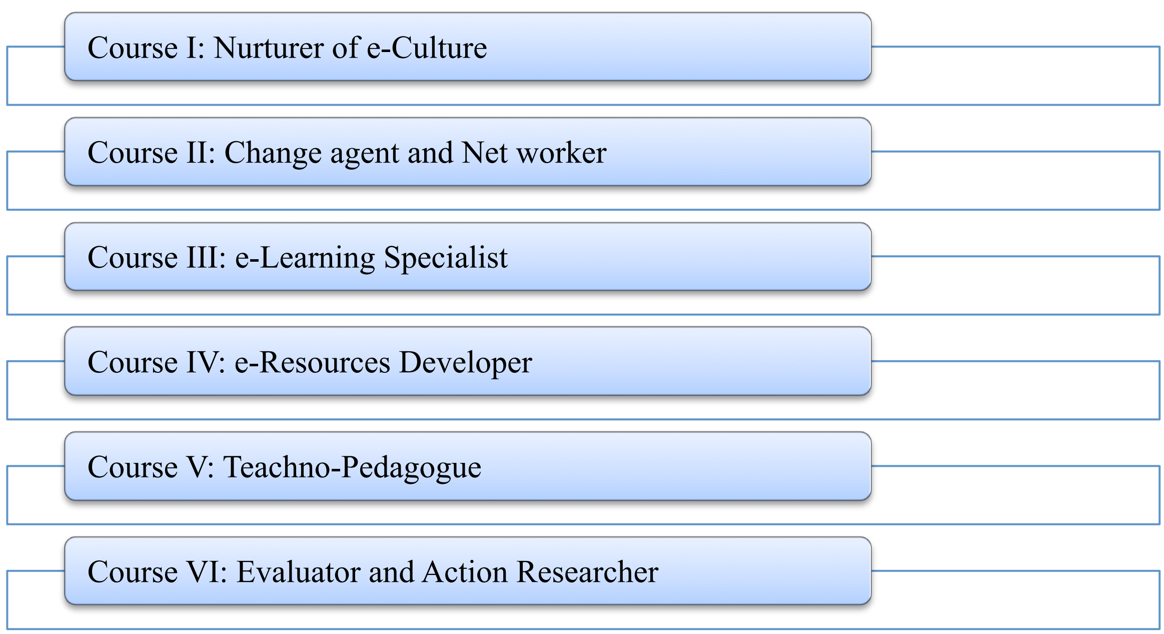
Program Structure

After conducting a job analysis by a group of about 35 experienced educators, six roles, the teacher is expected to perform in the emerging connected knowledge based tech savvy society, were identified and considering the activities to be performed and competencies and skills required for teacher to perform those activities/roles best possible way, six courses were designed, developed and deployed by the participating educators working for almost five years in the six course teams. [3].

Course Work

The total program consists of the following six role based courses along with learning activities, assignments and a project work (equated with one course of study) for the duration of two years, with the weightage of eight Credit Points each, totaling 56 CPs, to be completed in maximum period of five years:

Figure No. 2



Six Roles: Six Courses

This number may increase later, when newer roles are identified and courses developed for learners to choose.

(a) Learning Activities

The learning activities require learner to perform tasks which include practical work such as pedagogical analysis of school subject, concept maps, self-study of topics specifically prescribed; preparation and use of instructional material, teaching aids, PPTs etc.

(b) Practical work

The learning activities prescribed, practical work suggested and the assignments given are all field related, embedded in the course content and are open ended, open questions for free personalized application and skill development, providing for a variety of practical applications for development of self, as well as, the situate-class, school, community. Individuals are free to work on any application, resulting in, some new product or service or application.

(c) Project work

One major project involving field work related to situate development is a compulsory component. Project work could be related to education or industry like content development, infotainment, or edutainment. It has to address to the problem of real life like / work situation, in addition to the intellectual / creative growth of an individual and improved quality of the product etc. Project work is given weighatage of eight CPs.

Practice Lessons

Internship for school experiences includes Macro lessons & Micro-lessons to be conducted in technologically different learning environments, such as On-Line/Virtual Learning Environment-TEE (20 e-lessons), Mixed Learning Environment (20) and F2F Conventional Learning Environment (10), Total 50 lessons, all guided, planned, executed, supervised and assessed with detailed feedback to learner. However, in the pilot run it was decided that sample 2 lessons each will be conducted in six settings viz. Individual + computer with and without internet, small group with and without mentor, teleconferencing/distributed classroom and Technology enhanced classroom in f2f mode

e PASS

Major technology support in the form of e Platform and Support Services (ePASS), is provided by MKCL [4], a state government sponsored corporation, a business house established for propagation of mass computer literacy through a network of over 5000 Authorized Learning Centers in the state well equipped with more than 35,000 computers and state-of-the-art hardware, software and internet connectivity.

MKCL helped in creating and managing the e PASS including mechanisms and management tools and techniques like ERA- a LMS for the students, Course Design and Integration Framework (CDIF), Assignment Management System, Distributed class, using SABACETRA and ADOBE Connect as web conferencing tools for Course Teams for designing, developing, deploying and delivering, as well as, using and updating the course ware and SLM e.g. OER / Social Wealth etc, created through learning activities.

The ePASS provided support to students in their self study, to create and maintain e-Portfolio storing the artifacts created throughout the program, as well as, to work in groups, establish network for sharing learning resources, creation of databases, record keeping and developing tools for self and external assessment and evaluation.

Development Strategy

The whole exercise of development and deployment of the program is a participatory, co-operative, collaborative and consortium approach. It begins with the basics like identifying the key roles teachers are required to play and the competencies the teacher must possess to perform those roles, effectively. Based on this identification, the teams decided the expected learning outcomes for each course which helped in identifying and selecting the content to achieve those learning outcomes. A learning situation is developed to perform the role for resolving the problem and focused role is assigned, learning activities – both assessable and non-assessable – are prescribed, learning resources like suggested readings – both essential & additional – specified, reflective assessment of the learning activities by self is conducted and artifacts collected for developing Portfolio. Continuous review and updating of courses is done.

Curriculum Transaction

The curriculum transaction is on-line through Tech-MODE, through audio-graphic and video conferencing facilities reaching out to the schools and workplaces and managing interactive activities amongst users through three basic processes viz. Virtualization, Digitization and Customization.

Delivery Modes

The delivery of the courses is through distributed class, power point and multi-media presentations and through supplementary learning material in multiple formats, print-non-print, including lectures, audio-video cassettes, CDs, journals and textbooks, e-books, readings on net/websites and discussion etc. with a very powerful and continuous, virtual, as well as, real time student support system. The major delivery modes include

(i) Distributed class
(ii) Self – study: learning activities
(iii) Group work: collaborative / cooperative learning
(iv) Mentoring, tutoring and assignments
(v) Project work

They are briefly described here.

(i) Distributed class

Distributed Classes were conducted virtually from MKCL/YCMOU and received by learners at Study centers, Home, school- anywhere convenient to them. Distributed class activities include selection of the topic and expert, one page note on presentation, presentation and discussion, group work on activities and assignments under the guidance of Mentor, recording and creating repository of all such presentations. Six such sessions by local experts and two sessions by invited experts per course are conducted.

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(ii) Self Study

Each student is expected to work on his own using computers for, on an average, 2 to 3 hours daily, with online support. Also, face to face interactivity, at study centers with locally available mentors, sharing his / her experiences, worries, successes etc with peers in the groups created and maintained for group learning and working.

(iii) Group work- collaborative and cooperative learning:

Each student worked in learning groups formed by them or by YCMOU, or, in the Network of such groups created by MKCL, in discussion sessions after distributed class-at Study Centers, planning and executing the plan of action with mentors to guide, sharing with others resources and insights built during self study.

(iv) Mentoring and Tutoring

A mentor is a local in-charge of 10 students and their studies for the whole program. All learning activities are monitored and supported by the mentor, continuously. The mentor provided support services to the students like guidance in learning activities for self-study, assignments for self and collaborative learning etc. The tutor is an expert for each course, to support students, mostly online, not locally, for all the six courses.

Reflective Assessment and Evaluation

Both formative and summative assessment techniques are used. Formative assessment of events and assessable learning activities is conducted using time bound tests and, of non-assessable activities through rating scales. Also assessment of project is done for individual and for group contribution. Assessment covers self and group learning activities, ICT skills, study skills and situational analysis skills developed, situational learning and situated development activities including assignments and major project.

Summative assessment at the end of the course is done by the Quality Assurance Team and a concerned mentor in a comprehensive Viva-Voce and cumulative grade point is allotted after the presentation by the student of his/her portfolio and reflective evaluation.

Just to summarize the evaluation procedures, different forms of assessment used in the model include written assignments, practical assignments, responses made to questions in chat sessions, participation in group activities f2f and online etc. Final grade is awarded after evaluation of Portfolio, Project work and comprehensive viva-voce.

Since there is no course end / annual exam to be conducted but the assessment is continuous and comprehensive, as well as, on the basis of portfolio assessment, record keeping of the performance of the learner is very crucial. After successful completion of the program and acquiring required number of CPs, and after passing out comprehensive viva, the successful candidates get the Degree of B. Ed. (e-Education) certificate from YCMOU, the state Open University.

Up-gradation of courses

Continuous updating of the contents and the OERs for the program as an ongoing activity is a unique feature of this program. This is done by recorded interactivities and by continuous feedback that is obtained on day to day basis, as well as, in periodic review meetings, from all the players in the Networked System. This data is periodically analyzed for actionable knowledge, for learning lessons and for improving the program.

Paradigm Shift

This is an approach that comprises a total paradigm shift from old to new pedagogies and technologies, from static content delivery to dynamic learning resources like OERs, print medium to multimedia, local storage and access to distributed networked storage, limited local access to unlimited access to anyone/anywhere/anytime, no quality control to centralized quality assessment mechanism, non-replicating to replicating knowledge resources, and, single user to multiple user resources.

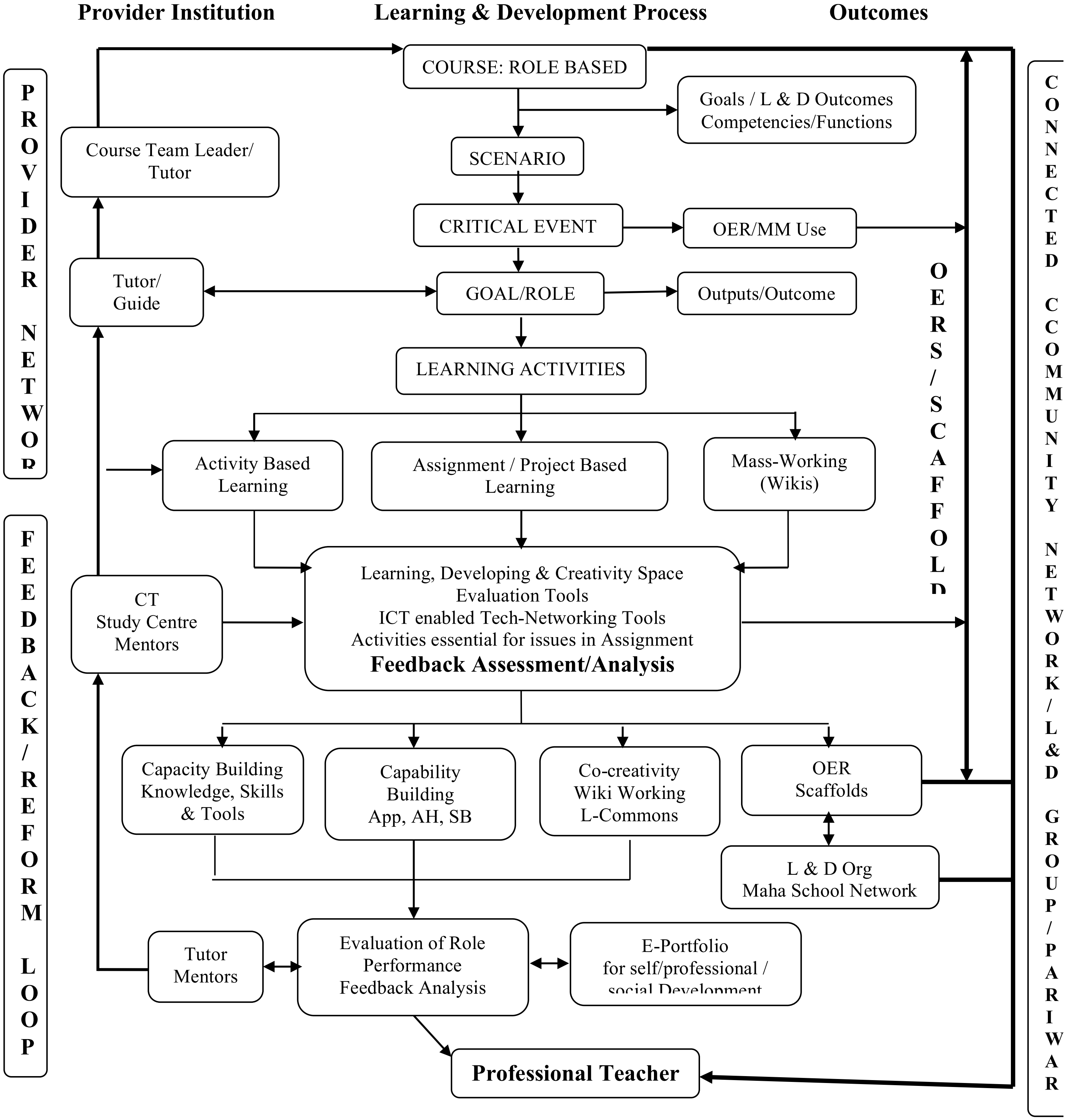
Impact

This program would equip the teachers to promote new learning processes such as learning to learn (self-study), learning by doing (performance), scaffolding (structuring), reflective thinking, learning through distributed class, personalized learning supported by e-learning resources (OERs),freedom to choose (Learners' autonomy), cooperative / collaborative learning (Group Learning), networked learning (distributed class) etc. resulting in development of learning communities through social networking.

Flowchart of the Model

The program is designed, developed, delivered, reviewed and assessed on the basis of above characteristic pedagogic principles of the model**.** These principles are reflected in all the practices of the program as indicated in the following diagram of the model:

Figure No. 3



I-CONSENT: Constructivist Role Based Learning Model [5]
(after Takwale, Ram, 2011)

The pilot run

The pilot run of this program was conducted for two years at three study centers, with the help of network of local mentors and national and international experts using the e-platform. In the forty seven students registered for this online course in the pilot batch were fresh graduates, working teachers, housewives, professional technogogues and others. From their reflections and feedback the lessons learnt show that [6]:

- The learners were a heterogeneous group with respect to communication and computer skills, besides their background. Those not much exposed to ICT, felt isolated within an e-learning environment, handicapped in virtual interaction, but techno-savvy students had less anxiety and more interactivity.
- The 'blended' approach and the presence and support of mentors at the distributed class (f2f) helped them to overcome these problems gradually.
- By the end of first semester, they were comfortably using ERA & SABACETRA, created and used blogs and social networking sites like 'multiply' for interacting with each other, sharing tips, clarifying doubts etc.
- They could also actively participate in the Webinar conducted by an authority like Susan Kovalik. The e-seminar and other learning activities involved a lot of collaborative work resulting in the e-culture in their work to some extent.
- Students and course team members had highly gratifying experiences. They felt that constructivist open environment, collaborative efforts, reflection, realization of changed thinking and insights developed, made them better educators
- They were able to reflect on their self transformation (**Aarti's** reflection on her blog received appreciation internationally), how one's social behavior is changed like collaborative, cooperative learning (**Shijo** sharing his learning, posting notes) etc.
- Many of them completed the projects for situate development (such as **Sayalee**, a house wife, adopted a rural, disadvantaged school and used 'Multiply' network for mustering help and collaboration for building a digital library there).
- Capacity building of the learner (e.g. **Madhuka**r, a professional trainer, after completing this program, felt so much empowered that he left the lucrative job and embarked on independent business-training workers for specific task).
- Continuous review and improvement in periodic review meetings of functionaries and students - resulted in useful up gradation of courses and technology.
- Transforming education for sustainable development is a major outcome, the three situates/locales for development being Class, School and Community.

Concerns felt:

While developing this program some concerns in the field came up to fore. For example, educators, and students of this program were grown up adults, a product of conventional F2F schooling. De-learning and re-learning was difficult for them.

- Work culture and study habits of students and mentors were not very conducive to learning and working in e - environment. Initially they found it difficult to cope up with newer activities like reflective thinking, group working, working with the person-person and machine-person interactivities, and use of ICT etc.

- The course writers had to undergo a painful process of un-learning conventional pedagogy orientation and learning and adopting constructivist pedagogy for work, orienting themselves in situated learning design, working for creating real life situations, developing courses, producing and field testing the program, getting feedback and updating the courses and finalizing the program for global marketing

- It was very difficult for participants to remain on the new line of thinking. They were constantly going back to old content-centric pedagogical approaches and ways of thinking and working which was quite frustrating to them.

- On the hind sight, every one realized (including the seniors like Takwale/ Deshmukh and course developers) how much their thinking had changed and insights developed during the years of working together in the program.

- There was a feeling of accomplishment all around when the pilot program was launched by Sir John Daniel, CEO, COL. They were motivated to do more-ready to accept multiple roles as student, mentor, tutor, expert, evaluator, provider, etc.

Most of above reservations were found rooted in uncertainty and unfamiliarity rather than the merit or limitations of the approach. Hence, subsequently the first two courses viz. Teacher as e-Culture developer and Networker, as well as, a two weeks training module in ICT applications - to ensure minimum required computing skills - are prescribed as a pre requisite for study of further courses.

Current Status:

At I-CONSENT, after successful pilot run (2009-11) and using the insights developed during the pilot, improving the Model and updating the program in the context of the feedback from the field, we are now in the process of fielding the program as a regular online teacher training program, through YCMOU in June, 2013, scaling it up in at least 10 centers/universities, covering about 1000 learners with the help of about 100 trained educators, thoroughly oriented in to the philosophy and practices of this innovative Model.

Also, alternatively, for the convenience of the working teachers, interested in ICT applications in teaching learning process, we are offering the program in a different format. We have converted the entire program into 10 role based, small, independent modules- in service online certificate/diploma courses with the facility to accumulate credits earned, as continuing education programs from the next semester, in June, 2013.

As a preparatory to this conversion, a workshop is scheduled in the first week of April, 2013 for the educators involved in the B.Ed. (e Education) program to develop the Open Educational Resources (OERs) for these courses with the support of COL. Prof Som Naidu, from CSU, Australia will be the expert resource person.

Conclusion

The program is now ready for adoption and use. Though the program is designed developed and field tested in the context of Indian continent, the commonality of the need of QE4A and the similarity of the adverse conditions found in the developing countries, especially the commonwealth countries, it makes it easier to adapt this Model to suit their cultural needs and educational practices. I-CONSENT is committed to support and help any commonwealth country in such adoption.

Overall results of the pilot run of the program are very positive and promising. The program is modified in the light of these experiences and now is available for the international consumption with a development centric-learner-centric model which will provide learning for development, through real life problem situations of which the learner is a part-experiential, contextual learning model to integrate the process of educational transformation in the system of - living-working-learning-developing together in a connected society with large techno-social structures. This model has indicated potential to provide a key to a much larger issue of QE4A.

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Training of Polytechnic Teachers through Blended Technologies: A-VIEW and MOODLE Web Based Technologies in the Western Zone of India

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Key Words: Teacher Training Blended Technologies. A-VIEW, MOODLE

Abstract

India has a large technical education system comprising of engineering colleges and polytechnics. Quality of education depends upon quality of teachers in any system. Therefore, Government of India has decided to launch a special mission on teacher-training. National Institutes of Technical Teachers' Training and Research (NITTTRs) have been working to improve quality of technical education in India. To take up this challenge of training about 80,000 teachers of polytechnics, NITTTRs have decided to use ICT based training using A-VIEW -A Versatile E-learning Tool for distance education using ICT. This paper describes NITTTR Bhopal's experience in conducting teacher training using blended technologies; A-VIEW and MOODLE Learning Management System. The experience suggests evolving new pedagogy more suitable for ICT programmes, incorporation of newer teaching methods, and sorting out of infrastructural bottlenecks.

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1. Background

There has been explosive growth in Engineering Education and Polytechnic Education in India since independence and especially in last two decades. Number of engineering colleges has grown five fold in last two decades. Similarly, number of polytechnics providing technician education in different disciplines is about 3700 [1]. It is estimated there are about 80,000 untrained teachers in these polytechnics. Ministry of Human Resource Development (MHRD), Govt. of India has given priority to train these teachers through four National Institute of Technical Teachers' Training and Research, serving the four regions of the country. National Institutes of Technical Teachers Training and Research (NITTTRs) are autonomous institutes under the Ministry of Human Resource Development, Government of India. They are dedicated to quality improvement of technical education system in the country. Institutes offer short term teacher training and long term regular programmes in pedagogy/ andragogy, and in content areas of various engineering, science and management disciplines. Each NITTTR trains about 3-4 thousand teachers every year through contact mode.

Development in India is undertaken through Five-Year Plans. Approach paper [2] to the Twelfth Five Year Plan (2012-17) states that "Pre-service and in-service teachers training has to be mounted on mission mode in the Twelfth Plan for which information and Communication Technology could be effectively leveraged" (Planning Commission of India). Blended mode of teaching/learning using ICT is considered effective strategy to reach out to larger population of technical teachers. As large number of teachers are to be trained, it was thought to use technology enabled learning to be used for the same. Contact mode training requires larger capacity to reach out to the teacher population in shorter span, and is difficult to create. ICT enabled blended teaching/learning is considered a viable alternative to address this issue. Therefore, it was decided to use **A-VIEW- The Versatile E-Learning Tool for Distance Education** developed by Amrita University, IIT Mumbai with the help of Ministry of Human Resource Development, Government of India.

2. Polytechnic Teacher Training in the Western region: Magnitude

NITTTR Bhopal trains technical teachers of western region consisting of states of Madhya Pradesh, Chhattisgarh, Maharashtra, Gujarat and Goa and union territories of Dadra and Nagar Haveli and Daman & Diu.

In all there are 901 polytechnics in the Western Region of the country. State wise number of Polytechnics is given below for the western region [3].

i). Madhya Pradesh	:	63nos.
ii). Chhattisgarh	:	42nos.
iii). Gujarat	:	125nos.
iv). Maharashtra	:	659nos.

v). Goa : 10nos.
vi). Daman and Diu : 1no.
vii). Dadra and Nagar Haveli : 1no.

As the target of training of number of polytechnic teachers is about 80,000 for whole country. Target for west region is training 18000 teachers of polytechnics. So in the next year (2013-14), NITTTR, Bhopal is planning to train 15000 teachers of these polytechnics through ICT mode using blended technologies. This is besides the annual training capacity of about 3000 teachers being trained through already scheduled contact mode programmes, being offered at NITTTR, Bhopal and at its four Extension Centres. Accordingly, the institute proposes to train technical teachers through A-VIEW/ICT enabled teaching/learning in project mode though a setup of remote centre (lead polytechnics) network of say 20 to 25 clusters in the western region of the country. As a pilot project nine programmes were offered in the year 2012-13. Next few pages describe the experience of the institute with ICT programmes, content offered, technologies used and so on.

3. Faculty Development Training Programmes: Offered

NITTTR, Bhopal offered nine 'Faculty Development Training Programmes (FDTP)' during the academic year 2012-13. In all 564 teachers of the region were trained through ICT/AVIEW based online programmes, out of which eight were 'Induction Programmes' which were offered to 522 nos. of newly recruited teachers and one programme was on 'Research Methodology'. We will discuss about Induction Programme here.

The **Induction Programme** aims at developing basic teaching skills among the newly recruited technical teachers of engineering education system. At the same time this programme also aims at developing professionalism in the practicing teachers including right values and desirable attitudes which enable them to perform the roles and responsibilities expected of them by the institutions effectively.

In view of the above, the programme has been designed and developed in two phases each of 02 weeks durations. The online teaching and learning process was delivered/administered incorporating online structured syndicate tasks/group/individual assignments to accomplish competencies by the teacher.

I. Induction Programme Phase – I [4]

The Induction programme Phase-I, is intended to create awareness among the newly recruited practicing teachers about the Technical Education System in India and develop basic core skills, essential in classroom teaching. The teachers joining the Engineering Education System are bound to accept the multi-dimensional roles and responsibilities, of which the teaching would be the main component. The main objectives achieved during the programme were as follows:

Objectives:

The trainees were able to:

- appreciate the concept of technical and technician education system in Indian context
- know the roles and responsibilities of technical teachers in engineering education system
- understand and apply systems approach to class room instruction
- understand the concepts of curriculum and syllabus
- understand the concepts and principles of learning, instruction and learning styles
- comprehend the concept of content analysis and analyze the given content for identified topic
- formulate instructional objectives of different domains of learning and their taxonomy
- understand concepts and principles related to classroom communication
- appreciate and use different methods and techniques of teaching
- comprehend the formative and summative evaluation of students' learning
- understand the concepts of guidance and counselling
- understand organization of an industrial visit
- understand planning, designing and assessment of laboratory and project work
- prepare and use an appropriate media for class room instruction and
- prepare and deliver instructional session plans for a given time duration on a topic identified

Contents

- Role and responsibilities of technical teachers
- Learning and instruction
- Content analysis
- Instructional Objectives
- Classroom Communication
- Overview of Teaching Methods
- Overview of Instructional media including preparation of simple media
- Student evaluation
- Instructional session planning
- Teaching practice with feedback

II. Induction Programme Phase-II [5]

The Induction Programme Phase-II is designed and offered only to those teachers who have already attended Phase-I. The Programme aims at developing requisite advanced knowledge and skills related to aspects of Educational Technology. This enables the practicing teacher to resolve various educational problems encountered by them, through implementing the course work developed during Induction Training Phase-I. The main objectives achieved during the programme were as follows:

Objectives:

The trainees were able to:

- understand the concept of curriculum as opposed to syllabus
- comprehend the process of design and development of curricula for Engineering Education programmes including curriculum analysis
- appreciate and use advanced teaching methods and techniques

- appreciate the philosophy of laboratory instruction
- design, develop innovative laboratory experiences
- design and develop items/questions as per specification table prepared
- prepare an Action Plan to implement the experience learning and
- prepare and present a Mini Project of integrating the overall experience of work performance

Contents

- Design, development, implementation and evaluation of curriculum
- Teaching methods such as case study, role play, project method, industrial visit/training, etc.
- Student assessment including pen-paper tests and others
- Laboratory assessment
- Use of IT in teaching-learning
- Development of Power Point Presentation
- Mini-project

4. TRAINING METHODOLOGY

In the past, training was conducted through video conferencing (analog) having one way-video and two-way audio. However, it did not elicit proper response and was gradually abandoned. Therefore, a new approach using multimedia capabilities of A-VIEW as well as using MOODLE as Learning Management System was thought of and is being described below.

A blended learning approach [6] to training was implemented proposed in which A-VIEW (Amrita Virtual Interactive Elearning World) [7] based sessions were conducted by tutors through video-conferencing setup from NITTTR, Bhopal hub, which will be received at Remote Centres (RC)/Polytechnics. Each RC is a lead polytechnic with in a cluster of neighbouring polytechnics falling with in distance of say 150-200 km. Teacher trainees of all polytechnics in a cluster, who register for a particular course, are required to travel to the RC for A-VIEW based interactive sessions. Initially training capacity of 30 teachers per RC was thought of. However, participating RCs varied from 5 to 45 participants. In addition to the A-VIEW, in parallel a Web based Learning Management System using the MOODLE Learning Management System(LMS) [8]was also setup to register the course participants, host course content in lesson format for each session, Tutor and peer interactions, and to administer online tests and quizzes.

In order to ensure learning and track the progress of instruction, the LMS was used. The trainees were encouraged for self-learning going through the materials and reflecting on the assignments; after providing expert lecture on every topic through A-VIEW. The trainees were expected to work and submit ten assignments. Involvement of participants at every successive stage of the assignments and programme activities gave pleasure of experiential learning. It also helped each individual to integrate the overall learning by way of completing assignment one after another leading to completion of Mini-Project. This added feature of the Phase-II provides them a unique experience and assists to inculcate desirable work attitudes towards teaching as profession.

4.1 Instructional Strategies

The blended technology based learning [9] approach has led to delivery of expert lecture through A-VIEW and simultaneously managing and administering learning through MOODLE LMS. Topic and content were identified. Instruction plan was development for teaching in blended delivery mode. The tutors identified the content to be engaged live using A-VIEW and part of the content to be delivered in self-learning mode through MOODLE LMS. Infrastructure for ICT/AVIEW and MOODLE LMS based online programmes was Setup.

I. The instructional strategy adopted in the A-VIEW E-Class Room
   - Generate Tutor IDs / setting rights as teacher for the tutors, workshop coordinators, and resource persons on A-VIEW course servers
   - Convert of lesson/ session contents in A-VIEW compatible structure and digital formats
   - Upload Content in A-VIEW servers, in order/sequence as per plan
   - Deliver engaging classes live and recorded
   - Provide access to lectures at varying bandwidths
   - Interact with Multiple teacher and student interaction through video and chat sessions
   - Share any kind of course content file and even on desktop
   - Share and discuss assignment submitted and providing feedback to trainees online at RC's at different locations
   - Interact with trainees through whiteboard and chat sessions
   - Use Handraise option for trainees to interact with teacher

II. The instructional strategy adopted in Learning Management System
   - Design and Prepare course material, pre-test, post-test, lessons, quizzes, assignments, cases etc in compatible digital format.
   - Generate Tutor IDs / setting rights as teacher for the tutors, workshop coordinators, and resource persons on MOODLE course server
   - Register/Enroll participants on course server using MOODLE LMS.
   - Launch Programme as per schedule.
   - Interact with trainees through instant messaging tools, engaging in a chat session and clearing their doubts through online discussion forums.
   - Provide online feedback to the assignments submitted by the trainees and tracking progress

- Administered and managed of the course as per schedule

5. Infrastructure Required at RCs [10]

It should be well equipped to conduct the workshop through the internet, for a minimum of 30 participants. The lectures are transmitted using the AVIEW software which will require the equipment and bandwidth as follows:

A-VIEW Hardware Requirements

Internet Bandwidth: Minimum 1Mbps broadband stable connection with public IP (2mbps recommended). At the time of workshop, RC will need stable 1Mbps internet connection with 512kbps download bandwidth and 256 kbps upload bandwidth (minimum).

- One Personal Computer with minimum 1GB RAM
- One Video Camera/Handycam with tripod (**Webcam is not acceptable**)
- To connect video camera to PC (any one of the following)
    - USB Video Capture Device or
    - USB/PCI IEEE1394 Firewire Card (if Video Camera/Handycam has Firewire out)
- At least one Professional wired or wireless mike/microphone (headphones or podium mike will not work efficiently for a large audience)

- One audio amplifier
- Two Speakers
- Cables and connectors according to your mike/microphone and audio amplifier's model. At least two cables will be required i.e. 3.5mm stereo to RCA (2) and other cables may be different because of different equipment models.

Classroom and LABS

- A large classroom with the following facilities, for a minimum of 30 participants, these systems should be connected through LAN and having Internet connection with min. 256 kbps sustained bandwidth.

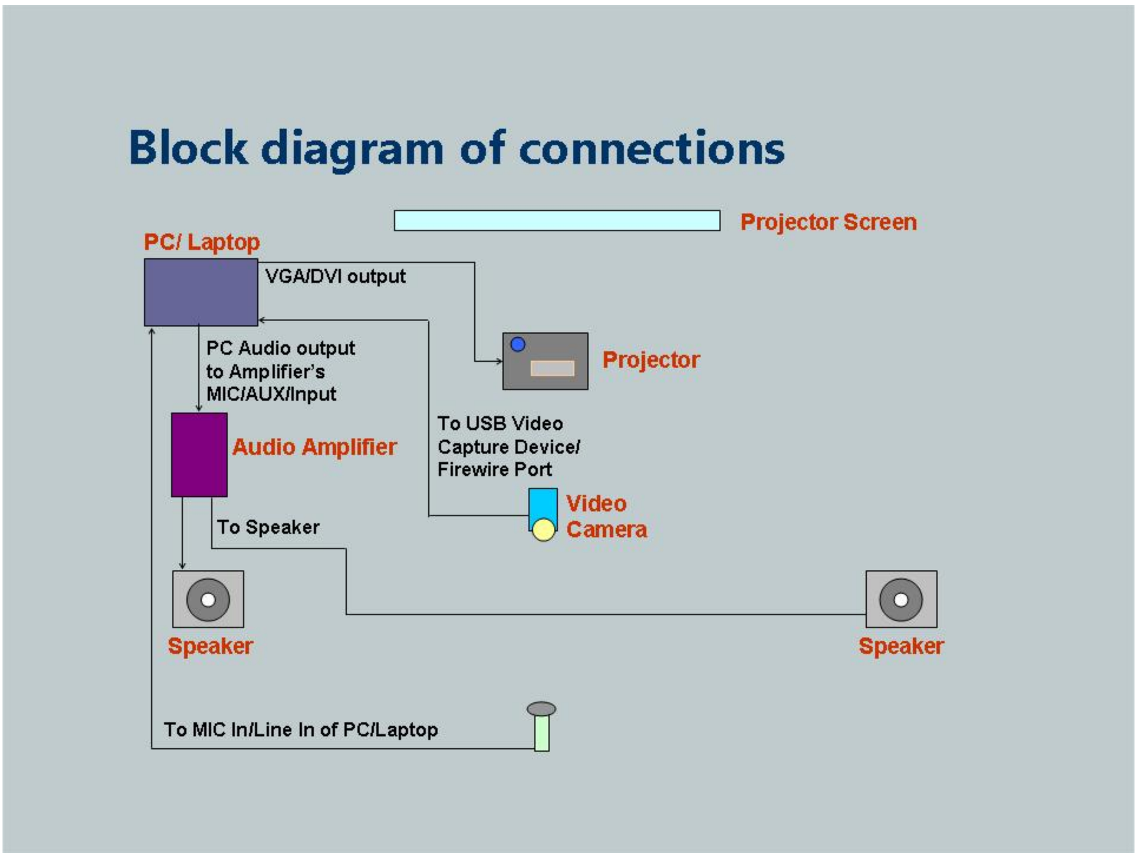
  - Overhead projector with large screen connected to a PC video camera (min. handy cam), audio equipment. (At least 1 professional wired/wireless mike **USB**
  - UPS to sustain PC/Projector.
- A laboratory for conducting experiments for a given subject, with a minimum capacity of 30 (subject wise details will be furnished in Coordinators' workshop)

Resource Persons Requirements

- In addition to the workshop coordinator the institute should also appoint a faculty member to be the coordinator for the remote centre, to be in charge of

 (a) Class room arrangements, audio visual equipments handling, and coordination of all operation for smooth conduct of interactive sessions.
(b) Logistics arrangements and supervision of lodging /boarding of participants.
(c) Handling of final accounts.

Fig.1 Block diagram for A-View Setup



Infrastructure/ facilities utilized at NITTTR, Bhopal

- A dedicated webcast studio with A-VIEW/ICT hub/workstation to telecast course content with high sped dedicated leased line connection is in place at teaching end.
- Creation of content in A-VIEW and Moodle compatible format as per the proposed courses is developed.
- A sever dully configured with Learning Management System for offering blended learning mode has been setup.

5. Output so far (in about 8 months of operation)

First training programme of two week duration on a pilot basis was launched in June 2012. Based on the feedback of participants, faculty concerned, coordinators and resource persons, changes were incorporated in the design of the programme. Subsequently, 7 more programmes of two week duration training 522 teachers were conducted involving 11nos. of Remote Centres (RC). Operational details for conducting programmes were also finalized and duly notified to RCs.

6. **Findings**

At present no formal research on the implementation of programmes, issues, impact has been carried out, however, qualitative impressions that emerges out on talking to different holders such as participants, course coordinators, lectures, resource persons are given below:

- Almost everyone concerned with the training is thrilled with the new mode of training, where they do not have to go to large distances for conducting or receiving training. However, as with any new technology there is reluctance to accept new blended mode of learning as replacement of face-to-face training programmes by the participants of training programmes.
- There are large number of tools are available on A-VIEW platform to facilitate teaching-learning process. Faculty conducting the training programmes have utilized these tools and are appreciative of vast potential of these tools in enhancing teaching-learning effectiveness. However, traditional two-way interaction of face-to-face training, especially of rhetorical questions and actual presence of trainer rather than screen presence of trainers is somehow missed and is difficult to replace.
- As the number of participants, becomes large, it becomes cumbersome to timely correct assignments and provide feedback. However, this issue can be sorted by assigning more number of faculty programmes to correct assignments and feedback.
- Some teaching methods work especially well with ICT based training, such as lectures and assignments and these are extensively used for conducting training programmes.
- Some of more interactive methods such as role play, case study, and group assignments with presentations, teaching-practice have limited applicability to such training programmes.
- There is almost consensus that new pedagogy needs to be developed to utilize new dimensions of training as provided by ICT. At the same time some replacement of time-tested continuous two way interaction need to be thought of.
- Infrastructural bottle-necks remain impediment in the effective implementation of these programmes.
- Bandwidth remains a major impediment, especially polytechnics located in rural areas. Average broadband speed in India is about 0.9 Mbps which is way below global average.
- Many a time, disruption due to power cut, also poses problem in rural polytechnics. However, one feature of A-VIEW that lectures gets recorded and can be viewed later, is useful in tackling this problem.

7. Closing remarks

ICT revolution in education and training is here to stay. It is likely to revolutionize the way education and training is provided. India faces challenges of training large number of teachers of both engineering colleges and polytechnics. The experiment with blended A-VIEW and MOODLE LMS platform has shown lot of promise[11] to contribute towards training such large number of teachers. There are some issues to be sorted out. New pedagogy must be evolved and infrastructural issues to be resolved, which will make training based on ICT mode more effective and practical.

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Integration of Technology Enabled Education in Learning: a Comparative Study of the Influence of Learning Standards in the U.S., Japan, Singapore, and Finland

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Abstract

This paper examines how technology enabled education (TEE) can be successfully integrated into the classroom by questioning whether national learning standards either incentivize or deter the adoption of TEE. For this purpose, we investigate practices and policies in 1) the development and implementation of learning standards in curriculum, teaching, assessment, and professional development, and 2) responses to these standards in the U.S., Japan, Singapore, and Finland. The adoption of the Common Core State Standards in the U.S. in 2012 has led to a first set of common national standards for American education. In Japan, Singapore, and Finland, national standards have been in place for decades with some modifications as a result of series of educational reforms. In particular, the paper discusses the following: the introduction of "integrated learning" in 2000 in Japan, the "Teach Less Learn More" (TLLM) policy announced in 2004 in Singapore, and the decentralization process that gave more autonomy to local authorities during the 1990s in Finland. Despite differences in the socio-economic, political, and cultural structures of the three countries, the three countries are trying to give more autonomy to teachers and local authorities in implementing their educational policies for national learning standards. Thus, a comparison of these three countries and the U.S. shows a sharp contrast in how they address national learning standards. By viewing education as a complex socio-technical system that requires a holistic examination in specific contexts, the paper investigates both effects and limitations of adopting learning standards in Japan, Singapore, and Finland, and illuminates potential unintended consequences that need to be considered for their development and implementation in the U.S. Further, once we have clarified the factors and conditions that influence the adoption of learning standards we draw conclusions about how these factors influence the adoption of TEE in each country. Through the comparisons and contrasts of the practices and policies on learning standards in the four countries identified above, the paper attempts to offer recommendations on how to implement rigorous standards that also encourage the adoption of technology enabled education.

Introduction

The adoption of national learning standards has become the most common method for attempting to improve a country's educational outcomes. Countries have had varying levels of success; some countries, such as Finland, have had their international ranking on comparative assessments such as PISA skyrocket and other countries, such as Japan, have declared their changes failures and seeking for an alternative way to reform education. We examine four cases, The United States, Japan, Singapore and Finland, and drawing from primary and secondary sources in each country, supplemented by interviews of educators in the United States and an ethnographic study of an elementary school in Japan, we come to conclusions about what factors determine the success or failure of each reform.

At the same time, educators around the world have become increasingly excited about the promise of Technology Enabled Education (TEE). The range of TEE is incredibly diverse and can be delivered in the classroom for a fraction of the cost of other educational materials. Most excitingly, TEE can allow the adoption of new pedagogical techniques, such as Blended Learning where students are exposed to both online resources and in-class teachers in concert and the Flipped Classroom, where students view the "lecture" as an online video at home which frees up time in class to conduct exploratory problem solving. We investigate the impact that national standards have on the adoption of TEE.

A Case from the United States

Though not implemented yet, the adoption of national learning standards has been a long time coming. As articulated in large national reports such as the Opportunity Equation (Carnegie Corporation), adopting national learning standards solves numerous problems all at the same time. Learning standards, though not used directly in the classroom guide the design of curriculum, instruction, and assessment at the same time (as articulated by the NRC, 2005). For years, changes in curriculum were accompanied by difficulties with assessments, changes in pedagogical methods were difficult because of the curriculum, and changes in assessment methods were difficult pedagogically. When designing learning standards, Achieve, the organization responsible for designing both the Common Core State Standards and the Next Generation Science Standards, considered the criticisms of all three so that these standards could solve all problems simultaneously. Since the Common Core State Standards have not yet been fully implemented, and the Next Generation Science Standards are not even in their final form, we have used interviews with teachers, principals, and state administrators to draw conclusions.

Curriculum

There are two main criticisms of the curriculum used in US schools: it is too broad and there is no common curriculum across districts or states. The first concern, over the breadth without depth, is often referred to as a curriculum that is "a mile wide and an inch deep." (Schmidt, Houang and Coogan) Unlike many top performing countries, the curriculum in the US contains so many topics that teachers have to spend only a small amount of time on each topic and can't go into a deep examination of any of the topics. Further, the lack of a common curriculum creates its own problems. Since each state and even district sets its own curriculum materials and lesson plans are not usable in many other classrooms. A national curriculum would tackle this problem, with materials being sharable across all different districts.

We have found that most teachers, principals and administrators concur that these standards are on the right track towards getting rid of the "mile wide and inch deep" curriculum. However, in order to make this shift, it follows that certain content must be removed to allow greater time spent on other topics. Some teachers are concerned about this shift, especially in the English and Language Arts, where a focus on non-fiction literature has met stiff resistance. (Ujifusa, 2013).

Teaching

Policymakers are increasingly concerned about the lack in progress towards teachers improving their instructional methods. Reforms after reforms have moved through schools in the last 30 years, and yet teaching pedagogy hasn't changed since the 1960s. Teachers interviewed, on the other hand, cite frustration at their inability to improve their teaching when there is such a large breadth of material to be tested on standardized assessments.

It is too early to see if significant improvements in pedagogy have come from implementation of these new standards, even in pilot classrooms. From our interviews, many educators explain that this is simply the result of the short timeframe of the implementation process. Teachers are spending so much of their time educating themselves about the new standards that they have no time to adopt new teaching practices as well. They have reported, however, that they are able to spend more time on the in-depth activities and no longer feel as much pressure to race through learning objective after learning objective.

Assessment

Over the last 15 years, there have been large changes to the assessment mechanisms in the United States. The No Child Left Behind act institutionalized large-scale standardized testing in all schools and mandated that schools with consistently low test scores undergo drastic measures to improve them. (NCLB, 2001) However, teachers and now a majority of the population are increasingly vocal about the downsides of "teaching to the test," where teachers only teach the facts that will appear on their standardized tests because of the high stakes attached to these exams (Rose and Gallup, 2007). While the public is not willing to do away with standardized tests (and accountability) completely, they are interested in improving these tests with improved technologies

The two large assessment consortia, PARCC and SBAC, and are running into numerous problems, and are thus much behind schedule. Alongside aligning these new assessments to the CCSS, they are also attempting to develop assessment techniques that move beyond the typical multiple choice questions that students are all so familiar with. Using new computerized assessments, these tests aim to ask follow-up questions based on student responses to determine better their understanding of the concept. However, this type of "deeper" assessment turns out to be even more costly and time consuming than experts predicted, and there are doubts that these new assessments will be complete in time for the full adoption of CCSS next year.

Professional Development

The bulk of the concern from both administrators and principles with the implementation of CCSS are with the professional development necessary. The Professional Development system in the United States is exceptionally varied; with some programs being very effective, and the vast majority being only marginally affective (Wilson, 2010). Most teachers interviewed did not think well of professional development, and because of their past experiences with ineffective professional development, they tended to assume new programs would also be ineffective. Yet, professional development must carry the weight of educating teachers both about the standards themselves as well as new pedagogical techniques for improving their instruction. However, there has been almost a singular focus on the part of administrators and principles in providing high quality professional development for to help implement the standards well.

Technology Enabled Education

Currently in the United States, there are a plethora of opportunities for students to use technology enabled education; from full time virtual schools, supplemental online courses to coupling digital instruction with face-to-face instruction. In 2010, 1.5 million students were using online or blended learning instruction, with more using these tools every day (Education Week 2011). However, the use of technology varies across the country.

One of the largest barriers to more teachers adopting TEE is the lack of unified national curriculum. When every state, and even district within each state, has a different set of standards developers are at a loss about what content to create. Most states have developed guidelines for the use of technologies to supplement technologies and have moved away from simply using technology to deliver content, but had previously done little to align these requirements to others states (ACT 2004). One of the most compelling reasons that states adopted the new CCSS and NGSS was the hope that common standards across the country would allow the sharing of resources, including TEE. Many teachers have been critical of large textbook publishing companies for claiming alignment with the new standards without adapting the content (Gerwetz, 2012), which serves both as a warning to TEE content creators to not follow the same path. However, this presents an incredible opportunity for TEE providers to establish themselves as a credible and reliable resource for standards-aligned material during the time when every school district in the country is instead evaluating new materials rather than being locked into the materials they have already sunk money into.

Finally, TEE will be able to harness the current technology infrastructure, which has recently undergone major improvements, to deliver their content. The federal government has invested heavily in providing broadband internet connections to schools that might not otherwise be able to afford it (US Department of Education).

A Case from Japan

Japan has a centralized education system administered by the Ministry of Education, Culture, Sports, Science, and Technology (MEXT). Compulsory education in Japan requires nine years, including six years of elementary school and three years of junior high school. Although high school is not compulsory, approximately 96% of Japanese students complete high school (with approximately 2% dropping out every year). To enter high school, students take an entrance examination at the end of the third year of junior high school.

In Japan, "integrated learning" was gradually introduced as a new course for students ("integrated studies") in 2000 as a part of a reform for "relaxed education" with fewer courses (2002-2011, 2012, 2014). The reform for more relaxed education originated in the 1980s from concerns over "cramming education," which was regarded as the root cause of school violence, bullying, and drop-outs. Many associate the beginning of this reform with the adoption of "integrated studies/learning" under the goal of creating the "zest to live" (*ikiru chikara*), "the ability to learn and to think independently" (Tsuneyoshi 2004:369) among students, not just cramming for exams.

Curriculum

The implementation of "relaxed education" and corresponding national curriculum in 2002 reduced the amount of the curriculum content and instructional time by 30% (Tsuneyoshi 2004: 388). As Japanese students' results on international achievement tests (such as the PISA and the TIMSS) worsened in 2003, MEXT announced the failure of the changes. However, not all education scholars in Japan agree with the Ministry's assessment, saying that this was too soon to evaluate the effects of the reform. The "relaxed education" ended in 2008 with more content and instructional time than the "relaxed education" but less than the previous amounts of content and instructional time. The amount of time spent on integrative learning decreased, while that spent on math and science increased by 18% and 23% in primary and middle schools, respectively (Bennesse). Although the new curriculum puts an emphasis on "zest for living" (*ikiru chikara*), MEXT states that the 2008 courses of study emphasize acquiring basic knowledge and skills, nurturing thinking abilities, judgment formation, and self-expression (*shikoryoku, handanryoku, hyogenryoku*). Accordingly MEXT has implemented "integrated learning" across courses, without allocating hours for this as a course, but by adopting a perspective that enables teachers to design courses that attain the goal of integrated learning, such as developing critical thinking and communication skills. (Robert Fish, Asia Society).

Teaching

Despite the effort to change instructional methods through policy change, Japan has not seen major change in pedagogical method as a result of the new curricula. Due to the revised curriculum in 2012 that adds more content and instructional time, many teachers are struggling simply to keep up with the demanding schedule: approximately 40% of those teaching reading and almost 30% for math thought they were behind their annual schedules (Benesse, 2012). Students have been found to communicate and explain more effectively but, at the same time, more children were reported to be "tired" or "cannot keep up with classes." In addition, 40% of teachers agreed that a gap between those high-achieving and low-achieving students was widening (Benesse 2012). The widening gap of students' academic achievement based on a social class background has been a major topic of academic debates since the introduction of the "relaxed education." It has been suggested by scholars such as Kariya, *et al* (2002) and Mimizuka (2008 from Benesse 2007-2008). As it was left to each teacher to design effective lessons for "integrated study" courses, teachers' ability and students' motivation influence the learning results.

Assessment

As Howard Gardner, the author of Multiple Intelligence, says "it's no good to have child-centered learning and then have the same, old multiple-choice tests that were used fifty or one-hundred years ago." In changing the pedagogy and instructional materials, the assessment system has to be revised as well. Out of this concern, university admission offices now offer an entrance examination that consists of high school grades, an essay, and an interview instead of written exams. This is an initiative to create diverse assessment standards under the guidance of the MEXT with a goal not to "teach/learn for the test". However, as the quality of students is reported to be worsening with this system, the effects of this system need to be examined. There is still a large emphasis placed on the entrance examination to go on to high schools and colleges, and as such, teachers at junior high and high schools pressured to teach to the test. Though some of them may be interested, teachers cannot freely experiment with integrated learning exploring higher learning skills. To adapt to the new curriculum, entrance examinations need certain modifications to reflect the learning results of "integrated learning" (such as higher-learning skills).

Professional Development

Under the current system, teacher training in Japan is multi-dimensional, continuous, and systematic at the national, prefectural, and more local levels. Among these training programs, induction training for newly appointed teachers for a year and the training program for teachers with 10 years' experience are mandatory. Under-qualified teachers take special training programs. In some extreme cases, teachers who have not proven their competence have been dismissed (Fujita 2007, 43-45). Overall, teacher preparation and qualifications are regarded as being adequate (Ingersoll 2007; Fujita 2007). However, MEXT reported in 2005 that instructional ability of teachers in integrated study varies from one teacher to another, and that the improvement of their instructional skills is listed as a future goal. As there are no textbooks nor guidance for the integrated study course as other subjects, teachers' creativity and planning ability are required to provide effective and meaningful "integrated learning" class and quality education (MEXT 2005). Despite generally strong pre- and in-service professional training, Japanese teachers were still unprepared to implement the new curriculum.

A major element of this strong professional development is the practice of Lesson Study. Lesson Study is the collaborative planning of a high quality lesson by a small group of teachers, usually four or five. Though the byproduct is a high quality lesson that can be shared by others, as implied by the name itself, the value for teachers comes through the reflective and self-critical process of developing these lessons. Through the iterative process, individual teachers take on the role of reflective professional researcher and can observe their own actions and the actions of others more objectively (Roberts 2010). Instead of being lectured at as in most typical professional development programs, teachers practicing Lesson Study are immersed in experimental pedagogical methods. This allows teachers to see the strengths and weaknesses firsthand and construct their own understanding of how to use these methods most effectively (Lewis & Tsuchida 1998; Lewis, Perry & Hurd 2004; Fernandez 2002).

Technology Enabled Education

Much of the focus in Japan on ICT has been in equipping schools with technology, with the Japanese government has committed to equip one device per student at school by 2020. As of March 2010 Japanese schools have one computer per 6.4 students, which is significantly less penetration than the one per 3.8 students in the US in 2005 and one per 3.6 students in UK in 2009. The "IT New Reform Strategy," established in 2006, aims to equip one computer per 3.6 students (MEXT 2011). 76% of primary schools, 69% of junior high schools, and 37% of high schools were equipped with electronic blackboards that can be connected to a computer for writing and drawing on the screen. However, this technology is not spread evenly amongst all the local prefectures. In Kagoshima Prefecture, 1 computer was shared by 4.5 students, while 1 computer was shared by 8.3 students in Saitama Prefecture.

There have also been effective efforts to train teachers to use these technologies. The IT Headquarters of the Japanese government proposed "i-Japan strategy" in 2009 to train all teachers in using ICT for classroom instructions by 2015. Currently, 62% of teachers have the ability to use digital media for teaching (Asahi Newspapers, December 7, 2011).

Further, the widespread practice of Lesson Study would make the adoption of TEE especially effective. Each teacher has developed a large number of exemplary lessons through the collaborative lesson planning process which can be shared with other teachers around the country. Further, because of the strong national curriculum, each lesson that has been planned is easily transferable to every other classroom in the country. These factors suggest that by collecting these exemplary lessons an extensive database could be created with multiple modules on every single lesson taught in the country, which would undoubtedly free up teachers' time from extensive daily planning.

However, Japanese policymakers have only focused on equipping and training teachers with ICT and have not been open to broader changes in school structures, funding and rewards systems or pedagogy that would encourage teachers to adopt TEE. Japan's traditional test-centric pedagogy of a "hierarchical flow of information from 'knowers' to 'nonknowers'" is often not open for modern uses of TEE, such a project-based learning for the development of skills such as critical thinking (Bachnik, 2003). There is little chance this will change: in *The Education Reform Plan for the 21st Century* published by MEXT in 2001 there is only one small mention of how students will use technology in the classroom and no discussion of how school culture might be changed to one more open to TEE (Vallance, 2008). Without extensive changes of the context that the teachers work within, there will be little progress towards to adoption of TEE, despite having teachers well equipped with both devices and training.

A Case from Singapore

Although the academic achievement level of Singaporeans is known to be high compared with other countries, Singapore only implemented its compulsory education system in 2003. In addition, the length of their compulsory education is only six years (Jason Tan 2010). Students receive six years of primary education, and four to five years of secondary education, followed by two years at junior college, polytechnic or the Institute for Technical Education (OECD 2010).

After primary education, there are 4 tracks of secondary education lasting 4 to 5 years, followed by 2 to 3 years of pre-university education. Students take national examinations after each stage of school. The first exam, Primary School Leaving Examination (PSLE) is given at the age of 11, in the 6th grade. In Singapore, the educational emphasis had been on rote memorization, rather than ability to think critically. The Ministry of Education (MOE) introduced a greater focus on creative and critical thinking and on learning for life-long skills, rather than simply learning to excel on exams. This process began with the 1997 reform, "Thinking Schools, Learning Nation" followed by the 2004 "Teach Less, Learn More" policy. For this vision, the Ministry of Education designed to tailor education to provide more flexibility and choice for students and transform the educational structures, such as to move away from the centralized top-down system to give more autonomy to local schools to ensure new forms of accountability given to each school. Each school sets its own goals and annual assess its progress (OECD 2010, 163).

Curriculum

TLLM was to open up more "white space" in the curriculum to engage students more deeply in learning. In 2005, MOE announced that the content was reduced by 10-20% (J. Y. Ng

2012). In 2005, the MOE clarified this philosophical statement to mean transforming learning from quantity to quality: “more quality and less quantity” in education (J. Tan 2009; P. T. Ng 2008; Darling-Hammond 2010). With the content deduction of the curriculum undertaken with care, students remain well prepared for post-secondary education and continue to meet international standards. The curriculum focuses on the fundamental of effective teaching to engage students with a holistic understanding of the content beyond preparing for test and examinations (Ng 2012). Due to this policy shift, more scholars report that schools are trying to engage students with learning, rather than with teaching. However, learners were still seen as too passive, overloaded with content, driven to perform, but not necessarily inspired (Ho Peng, interview at the Asia Society).

Teaching

Traditionally, the emphasis of Singaporean education had been on rote memorization. TLLM promoted different learning paradigm, which was less dependent on rote learning, repetitive tests and instruction, but “more on engaged learning, discovery through experiences, differentiated teaching, learning of lifelong skills, and the building of character through innovative and effective teaching approaches and strategies.” (Ho Peng, interview, Asia Studies)

Every two years, the MOE evaluates schools’ “implementation and response” to the “Teach Less Learn More” policy. Due to this system, there are more increased levels of professionalism amongst teachers. It has been observed that didactic instruction in the classroom has been reduced and students have gained more confidence (J. Y. Ng 2012). The introduction of teaching assistants in the classroom, known as Allied Educators, has also helped to support the focus on quality teaching and learning. (Ng 2012)

Assessment

The education system in Singapore is based on meritocracy. Academic grades are considered objective measures of students’ abilities and efforts, irrespective of their social backgrounds. Many students are pressured by their parents and teachers to do well in their studies. The Singaporean government provides grants to community bodies to offer tutoring for low-income families.

Despite these reforms, it is reported that there was no change with assessment. Teachers routinely feel pressured to “teach to the test” and end up relying on rote learning (J. Y. Ng 2012). There are however alternate tracks: students who intend to go on to college can skip O-level exams by entering Integrated Programme Schools, which combines Secondary and JC education without an intermediate national examination. At these schools, students can engage in broader learning experiences that develop their leadership potential and capacity for creative thinking (OECD 2010, p. 165)

Professional Development

Strengthening its teaching force has been critical to the success of the Singaporean education system. MOE has been trying to build up a strong qualified teaching force through a process of careful and detailed planning, aggressive teacher recruitment, comprehensive training and effective teacher retention, both quality and quantity (CPRE 2007, p. 71). All teachers are hired by MOE from the top one-third of each cohort. All teachers and trainee teachers receive pre- and in-service training at the National Institute of Education (NIE). NIE works symbiotically with MOE to give advice on hiring of the teachers. Trainee teachers are paid as well, and jobs are guaranteed with the completion of pre-service training at NIE. Teachers do not need an undergraduate degree for primary teaching. As NIE and MOE work closely in hiring, establishing standards for contents and pedagogy, there is no issue of unqualified teachers. More and more school leaders (principals, vice-principals) have a master's degree (CPRE 2007, OECD 2011 video).

The MOE has also provided resources and support for schools, including Professional Learning Communities (PLCs) in schools and Centres of Excellence to "facilitate sharing of good teaching practices among teachers and schools." However, it is also reported that teachers are under high levels of stress, as the country is shifting towards a more knowledge-based economy. The reform to facilitate teaching is placing more pressure on them. In addition, the sociocultural practice of competition is wearing upon them (Handbook, Ch. 4).

Technology Enabled Education

Use of ICT in education in Singapore began in earnest with the First Masterplan (1997-2002) with a goal to provide the basic ICT infrastructure and to equip teachers with the basic levels of ICT competency. It aimed to allow students to have computer usage for 30 percent of their curriculum time in fully networked schools and at a computer to pupil ratio of 1:2 (Aguirre 2012, Pak Tee Ng in Rubin 2012). Following this, the Second Masterplan (2003-2008) was announced to create an effective and pervasive use of ICT in education (Aguirre 2012). This encouraged teachers to use ICT in teaching and learning (Dr. Pak Tee Ng in Rubin 2012). The Third Masterplan (2009-2014) was implemented to continue the previous plans' philosophy and did not make major changes to ICT policy. (MOE 2008, Aguirre 2012, Pak Tee Ng in Rubin 2012). In 2007, the student to computer ratio was 6.5:1 in primary schools, 4:1 secondary schools and junior colleges, and each teacher was equipped with a notebook computer. ICT was integrated about 30% of the curriculum time (Koh 2007).

The MOE has created a differentiated professional development focused on how ICT can help students learn better, and provides a training program to develop a group of practitioners in their ICT-related pedagogies and coaching competencies, with a goal to place about 4 such ICT mentors in each school (Pak Tee Ng in Rubin 2012). Schools have supported this effort with the Next Generation Broadband Network (NGBN) providing ultra-high speed wireless connectivity (Aguirre 2012, Dr. Pak Tee Ng in Rubin 2012).

A Case from Finland

Compulsory education in Finland is 9 years, from the age of 7 until age 16. Overall, 98% of children attend preschools (universal day care is provided from 8 to 5 months of age since 1990; 1 year of preschool/kindergarten is provided at age 6 since 1996), but early childhood education is not mandatory. The completion rate of compulsory education is 98%. If students score multiple failing grades during that time, they may have to repeat the year (with pupil and parental consent). All school-related expenses, such as school healthcare, lunch, books and materials, and school trips are free during the first nine years. At the age of 16, students choose whether to undergo occupational training to develop vocational competence or to enter an academic upper school for university and post-graduate professional degrees. Upper secondary schools are 3 to 4 years long. Finnish class sizes are small, with approximately 20 students per class, and they further divide students into groups (Nishijima 2005). Students stay with same teachers for several years, and there is no ability-based tracking.

From 1970 to 1985, Finland centralized education standards and adopted their first national standards. Then since 1990, Finland has focused on decentralizing power, giving teachers control over their own teaching methods and only having a framework curriculum. The national curriculum is set as broad guidelines for teachers, and more trust is placed on teachers as professionals, who all have a master's degree. These teachers are the top 10% of the graduates, and they have a status as high as doctors and lawyers.

How the Finnish understand education and learning is different from what has been encountered in Asian countries. They have a philosophy of equity and equality, and they believe in a high degree of personal responsibility and individuality. They emphasize caring and cooperation with others, rather than competition. There is more focus on "learning to learn" (or critical thinking) than on learning the subject matter. Pasi Sahlberg (2010) says in the Hechinger Report that "the important thing is ensuring school as a place where students can discover who they are and what they can do. It's not about the amount of teaching and learning." In addition to free education, free school lunch and health care, they have a culture and philosophy that enables students to be motivated towards learning and the student-centered learning style. According to Sahlberg, this educational environment was the result of the reforms of education and social systems in the 1970s.

Curriculum

Finland has a National Core Curricula for Basic Education and Local Curricula. This document created 1) a loose conceptual framework describing intended experiences, rather than content; 2) schools were invited to design their own curricula (though not required to do so); 3) increased flexibility and freedom of choice; 4) focus on a new conception of learning; and 5) support to schools for curriculum design (Sahlberg 2010). Many have suggested that this tight control was essential to the success of Finnish education, before gradually loosening once well-qualified teachers were in place (Tahka et al 2012).

Standards were the very first step in education reform in Finland. They used higher standards to influence teachers of all abilities to get on board. Further, and perhaps more importantly, high standards raised the interest of many students in higher education, eventually depressing the wages of a master's degree enough to allow Finland to require a Master's degree (OECD 2010).

Assessment

In Finland, there is only one standardized test at the age of 16. There are no state mandated tests every year, and assessments are primarily given both formally and informally by teachers. Further, students are not measured in comparison to others in the first six years. (Hancock 2011). No ability grouping, either, due to the notion of equity. Without creating high stakes tests for students as in Asia, Finland has achieved a high school completion rate of 93% and a high ranking in international achievement tests.

Teaching

The classes are designed so that lessons are based more on student input (60% student input, 40% teacher input); they focus on student-centered learning and let students discover concepts rather than teaching those concepts. The lessons are based on debate, and there is very little testing and homework. They employ technology for learning, with a strong emphasis on innovation and entrepreneurship. Debate-based lessons are also provided, and there is very little homework.

Teachers in Finland are currently more concerned with how to educate good students in a comprehensive school setting (interviews in Nishijima 2005). Comprehensive schools without ability tracking seem to work well for assisting low-achieving students, but they may not be effective for assisting students who are excelling (Okubo 2012). Therefore much of the professional development focuses on the enabling teachers to teach to groups of heterogeneous students.

Professional Development

A large part of Finland's success seems to come from their strong pre-service professional development program. A Master's degree is required for all teachers, requiring both in depth subject knowledge and general understanding of education principles and pedagogies. In addition, they have to demonstrate their knowledge and skills through writings and discussions in the examination to be hired as teachers.

In its economic, social, and educational policies, Finland places significant importance on collaboration and knowledge sharing (Information Science Advisory Board, 2000, p. 5). The educational policy is coordinated with this idea, and the Information Strategy for Research and Education was developed. It emphasizes the need to develop information society skills in all students, the building of open education and research networks, and the development of educational information products and services (Kozma 20XX).

Technology Enabled Education

With the large amount of local control, there is a wide range of technology use by individual teachers, but overall, technology use in Finnish classrooms is low. Teachers seldom involve technology in the classroom, and when they do Finnish teachers tend to use technology to support the same pedagogical styles they have been using, not to adopt new pedagogies. (Ramboll Management, 2006) Further, teachers have identified that interesting content available through new technologies will be what attracts them to use such technologies in the classroom.

Finland has the infrastructure to support the use of technology in the classroom with wide internet access and many computers in each school. However, the national guidelines in Finland regarding the use of TEE in schools are intentionally vague to allow teachers to guide their own classrooms and adopt new technologies as soon as they appear. While well-intentioned, this policy has allowed many teachers to avoid adopting new technologies and pedagogies in the classroom (Thayer, 2012)

Discussion

Each of these countries has clearly taken a different path when attempting to implement new national standards, however there are lessons to be learned through the comparison. All of these reforms have been centered around the recognition that education systems are not just teaching students lists of information and that they are also equipping students with necessary skills (such as critical thinking, creativity, etc.) and developing their interests in various subjects. Thus all four countries have centered their reform at least somewhat to require less content in their curricula in order to free up time for deeper investigation of various topics and new pedagogical methods.

First of all, from the implementation of these standards we can see that there needs to be a coordinated approach across the entire system. Assessment has to be based on students' demonstration of skills rather than memorized facts. Without this, alignment with the assessments drives students and parents to demand rote teaching and learning in school or outside school, as is the case in both Singapore and Japan. Teachers must also be prepared to teach in new methods by professional development, both pre-service and in-service, or they will not be able to achieve the desired outcomes, as was seen successfully in Finland and Singapore.

Further, we can see teacher buy-in is essential for the success of reforms. It is clear that increasing the autonomy for schools and teachers encourages support for reforms, as is the case in Finland. Singapore is also trying to increase local autonomy by giving greater autonomy to schools and rewarding successful school for accountability. When moving from a centralized system to decentralized system, such as in Finland, the formal structure persists long enough to allow for effective dissemination of practices and information early in the implementation. Typically, the strongest advice networks for teachers are the informal bonds with other teachers, usually locally through their schools or over the internet, which are hard to break into. Local control in Finland and Singapore harnesses these informal connections instead of fighting against them.

Finally, policymakers need to consider how social structures and contextual factors drive change within the education system. Educational reforms are most effective as a part of all social reforms to create a sense of equity and sharing in society as was the case in Finland. Without these changes competition remains intense among students and parents and performance on testing is the largest incentive in education. As in the case of Singapore and Japan, teachers try to meet parents' expectations to teach to these tests. Small (Finland and Singapore) and homogenous (Finland and Japan) countries can also more easily adapt to local problems in implementation.

However, these lessons learned for the successful implementation of standards paint a bleaker picture for the adoption of technology enabled education. While introducing autonomy to teachers in Finland and Singapore has been successful for improving the educational outcomes it has proven to be a barrier for the implementation of TEE in the case of Finland. These tools are not disseminated easily through informal networks and few teachers besides those already interested in utilizing technology in their classroom end up using TEE. Further, without explicit encouragement or regulation, those teachers who do adopt TEE primarily use these methods to support old pedagogies.

Further it is clear that the success of TEE is directly tied to the professional development that accompanies it. Singapore has been able to utilize TEE most effectively because of the support given to teachers. For countries like the United States, with a professional development system that is largely seen as ineffective and over-tasked, TEE will need robust professional development alongside typically professional development. In most countries surveyed, there was little if any formal pre-service training regarding the use of TEE in the classroom, and each teacher was left relatively unprepared to adopt TEE.

Throughout the process of adopting new standards, there are points of leverage that might enable widespread use of TEE. As new assessments are being created to test the higher-order skills such as critical thinking and problem solving, test designers have created new psychometric tests involving, for example, the manipulation of computer models. The use of such assessments would naturally incentivize teachers to "teach to the test" using modern TEE tools. Further, many new standards documents, such as the Next Generation Science Standards in the United States, explicitly call for the introduction of new technologies in the classroom.

The adoption of new educational standards is never a predictable process. Even small changes in the education system can have resounding effects for teachers and students. A careful consideration of how to integrate TEE into the classroom, and subsequent inclusion in national standards, can incentivize the adoption of new pedagogical techniques using TEE. Most importantly, the lack of inclusion of TEE in standards, or an unclear or ambiguous policy, is a major hurdle set in front of the adoption of TEE.

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Reducing Teacher Resistance to Change and Innovations

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Abstract

This paper discusses the reasons of teacher resistance to change and innovations in educational settings with particular respect to the role of teacher education. It emphasizes the kinds of innovations, their characteristics, the reasons of resistance of teachers in using technology and some suggestions to handle with this important problem of our age. In order to pave the way for a new and modern society, it is essential to create awareness and to educate teachers as open-minded, innovative and far-sighted individuals to innovations and well-informed users on the recent technology. In this paper, the author, who is a curriculum designer and instructor, will share her experiences within the in-service and pre-service educational programs of Turkish teachers on the way of reducing resistance to change and innovations.

1. Introduction

We live in an era of "Information, Technology and Communication". The mode of communication has changed recently through the use technology in the global world. It has become virtually instead of leaving the materialistic manner, such as; paper, envelope and stamp. The internet is the most important factor for this change. It is the fastest one among the other networking systems, and brings the most widely known information net to our homes and deserves being one of the best inventions within the last twenty five years. Even though the internet is a gigantic library in our houses and schools which makes our lives more comfortable and more time saver it might be difficult for some people to be adapted to the changing technology and as a result might cause resistance to use.

It is known that instructional technologists are responsible for implementing and fostering the adoption of a variety of innovative programs and devices to improve the teaching-learning process. Without doubt, instructional technology and its potential to improve instruction have progressed more rapidly than acceptance and utilization in the classroom. *"The largest single factor affecting adoption is teacher resistance"*, VanWyck [1] says. "*With several years of additional experience on a wider variety of academic levels, it is more apparent to that, to effectively reduce resistance we must be more practical in terms of objectives and needs."*

On the other hand, Fullan [2] says; "*Change is a double-edged sword*." and he adds; *"If you ask people to brainstorm words to describe change, they come up with a mixture of negative and positive terms: On the one side, fear, and danger, panic; on the other, risk-taking, excitement, and energizing. Change arouses emotions, and when emotions intensify, the leadership is the key."*

It is clearly seen that upon the recent fundamental changes in technology and as a result the need for change in instruction at schools necessitates the redesign of teacher education. That is especially important when the teacher leadership and guidance are considered vital factor for training qualified generations.

Characteristics of Innovations

In order to develop an appropriate frame of reference, a brief examination of the characteristics of innovations may be listed. An innovation has two characteristics:

1. An idea, method, object or piece of equipment which is novel to the individual or group.

2. The anticipation that some desired change will result from the adoption of the novel idea, method, object, or equipment, and related materials.

Evans [3] defines four major components influence the process whereby an individual or group becomes aware of, evaluates, and finally accepts, resists, or rejects the innovation:

- The innovation itself,
- The process, its production, promotion, and adoption,
- The characteristics of the individual or group comprising the social system,
- The nature of the social system.

Reasons of Resistance

Brickell [4] suggests that major innovations require significant shifts in the normal operating procedures of six structural elements of a school or institution: Teachers, students, subjects, methods, times and places. Some innovations require acceptance or rejection by the entire school or institution with little freedom of choice for the individual. For instance, the implementation of modular or flexible scheduling requires the commitment of the entire staff. Other innovations permit the individual to accept or reject independently of group action, such as in the development of a televised course or the implementation of a film-making unit. If it is thought from the point of view of teachers, it brings in the autonomy of teachers within the classroom. Much of the literature on teacher resistance has been corroborated through many years of personal experience of researchers consulting with and assisting teachers on elementary, secondary and higher education levels [4]:

- Any sudden or formidable change in the traditional role of teacher and student is likely to elicit some form of resistance.
- Many teachers and administrators feel that technological innovations tend to promote a mechanization of instructional process, which thus becomes “dehumanized”, resulting in a loss of feedback between student and teacher.

- The degree of complexity of innovations and/or changes, particularly those involving equipment, has a strong influence on acceptance, resistance, or rejection. "*If the equipment is not technically reliable simple to operate, and readily obtainable, resistance can be anticipated",* Aquino says [5].
- Some of the innovative failures are caused by ignorance, which existed when innovation was unknown or its complexity led to a lack of understanding.
- Sometimes innovation is not accepted because it was not used in the past.
- Teachers are confident of the success of their own methods, making innovation unnecessary.
- Sometimes the cause is psychological. It does not fir the personality of the teacher.
- Or, the cause is interpersonal relationships; if colleagues do not use it, why should I?

Ways of Reducing Resistance

According to Rossi and Biddle [6], an innovation is less likely to cause resistance if it supports or slightly modifies current educational practice rather than changing or replacing the practice. Another important point is the "Role of administrator" as "Change agent". It is necessary for teachers and administrators to work cooperatively in a spirit of common professional concern to initiate desired change in instructional programs.

Persellin [7] lists some conditions before innovations have a change to succeed. They are as follows:

1. The educational community must perceive and express a specific need for change.
2. The need must be recognized by the community at large.
3. A state of the art in both methodology and media must exist for meeting the need in a cost-effective manner.
4. Sufficient funds must be available for paying the cost.
5. Teachers should be prepared for the change adequately.

Another important point is taking the advantage of experience and wisdom of teachers in the planning process, particularly in the establishment of programs to bridge the gap between the old and the new. Teachers must be allowed, and should be encouraged to participate in the evaluation and selection of equipment, materials and policies related to their use.

We must prepare students and teachers for the innovations. In-service programs and workshops must be carefully planned so that all involved, are better able to handle the inevitable problems associated with change in an ongoing system. For example, a teacher should be familiar with the advantages and limitations, and feel comfortable using a cellular, a video or a computer.

To sum up, essentials for successful innovation and /or change can be listed as follows [8]:

- Adequate participation in planning by all those who will be involved at various levels and stages in implementing a project.
- Support in principle from those authorities who have responsibility for education in the area in which an innovation will operate.
- Sufficient preparation to ensure that the teachers who will be involved and the facilities at their disposal will be capable of meeting the demands placed upon them.
- Clear identification of the limits within which an innovation may operate and the extent of the supporting services that can be provided.

Developing Solutions to Teacher Resistance

Technology has been changing rapidly. The innovative use of technology is one of the best solutions to remove the obstacles between teachers and learners, teachers and teachers and also to remove the walls among the countries. Ineffective leadership is one important single factor in our inability to significantly reduce teacher resistance to innovation. Another one is training. A Brazilian educator Eduardo Chaves says; "*We are born incompetent and dependent. But we are born with an incredible capacity to learn. Education is the* *process by which incompetence is translated into competence, dependence into autonomy. This process takes place through learning*".

As people in the world today, we stand on the cusp of the information age. We are now moving rather swiftly toward this revolutionary social transition [9]. Factors that tend to reduce resistance are teacher understanding and involvement, in-service training programs to bridge the gap between the old and the new, efficient support services, effective communications, understanding administrators and confidence in the media professional responsible for implementing desired change. It seems logical, therefore, that teachers should be trained in the utilization of the modern technology. Therefore it can be said that technology must be used in such a way that it should not only satisfy the needs of the students in a qualified manner and it must also be the meeting point of teachers with other creative and innovative teachers. Thus, students will again get benefit from such coincidences. In order to open that gates of innovative learning programs and modes to young students; universities, companies and some research centers are trying to design new programs on the way of reducing teacher resistance. Some IT companies collaborating with the Ministries of Education try to create new environments to meet teachers with other teacher who follow more innovative routes in their classes. The sharing platform in those programs, naturally, becomes the Information and Communication Technologies (ICT) and the Internet. The author shares her experiences as the localizer of an international ICT Program within Turkey on the way of reducing teacher resistance to change in the following section [10].

A Case from Turkey: Innovative Teachers Program

"Innovative Teachers Program" was developed by the experts of an IT company as a part of their "Educational Initiative". In July 2005, nearly 100 educators from 23 countries came together in Washington, USA to explore their mission on the frontlines of education. During that event, teachers investigated leadership, teaching, and learning in thoughtful exchanges with peers and leading thinkers in Education.

Teachers also shared best practices and insights of their own. At the moment, more than 100 countries have been implementing that program. As part of the initiative, the authorities of the company collaborate with local and international experts and seek to increase access to latest computer technologies in educational institutions.

The author, with some qualifications such as being an ex-high school teacher, a curriculum designer, a teacher-trainer and a quality expert, worked as one of the local partners of that company in Turkey between the years of 2004-2009 [8]. The author participated in many international meetings and seminars as the advisor, localizer and also the trainer of the Innovative Teachers Program to internalize the philosophy, and then, she prepared a 32-hour Program for the future "Innovative Teachers" of Turkey. She wrote and edited the book and other training materials of the program in 2005. After two pilot groups, she modified the training contents and prepared for the implementation step. With the collaboration of the authorities from the Ministry, she trained nearly two hundred teachers at four different regions of Turkey. After each training program, feedback was collected from the participating teachers, modifications were done, and the Program was handed in the Minister of Educational Technologies of the Ministry of National Education in 2009.

After the training of "Innovative teachers", the next step was to determine the volunteer "innovative teachers" to be "Innovative coaches" for their own school districts. For, the "Cascade Model" would be used to increase the number of innovative teachers within Turkey. At that time, there were 650,000 teachers working different levels of Turkish schools. The author prepared a different set of in-service training program:

1. A 32 hour-training program for the Innovative Coach trainees and
2. A 12 hour-leadership training program for their school principals.

As it has been easily understood, It had been designed as a "Collaborative Coaching Program". The author focused the program to the cultural values of Turkish people which is shortly known as

İmece (=Collaboration). The pilot studies were done with four teams and after the modifications they were also delivered to the Ministry. Some of the trained teachers, in other words "Innovative teachers" participated in the "Worldwide Forums" in Helsinki and in Philadelphia. They won various awards. The program still goes on in Turkey and the experts of the Ministry are continuously training new innovative teachers.

Including Teacher Trainees into the Program

The author has been working at Educational Faculties to train innovative and quality-focused future teachers. While training the future innovative teachers through the collaborative in service programs of Ministry; she also has decided to include the students of Educational Faculties into the movement. She designed and opened a course under the title of "Innovative Teaching" at Boğaziçi University in the Spring Term of 2005-2006 Academic year. Each year, the program has been developed gradually and adapted to the changes in the era. The course has been going on for seven years. In the academic year of 2011-2012, the title of the course was changed into the "Teachers of the Future". More than 500 teacher-trainees elected the course. The Syllabus of the course is as follows.

TEACHERS OF THE FUTURE

Course Objectives:

The Objectives of this course are to develop a basic understanding of Quality, Personal Quality, Quality Leadership among the future workforce of the community, the difference between innovation and innovativeness, to internalize how to "manage change" in 21st Century rganizations, to learn the recent techniques and approaches concerning ınovation, leadership roles and skills in the work environment, to understand the importance of using technology at various settings through some "Information and Communication Technology (ICT)" projects and some innovative techniques for the new life styles, to be familiar with the problems of challenged human resources, to learn how to conduct İmece (quality) circles and to improve "peace and quality" concepts at work. On the other hand; Leadership Styles, *Personal characteristics of Effective Leaders, Leadership Skills in the Society and various organizations, Communication Skills, The Role of the Leaders in Strategic Planning Process, Managing People, Managing Organizations and Managing Change will be studied in detail to develop a global understanding for the changing world. Each term a new issue is analyze; like "The Challenged", "Human Dignity" or "Peace".*

<u>*Target Group:*</u> *This course is for the ones who are very close to their graduations professional lives. Recent developments in daily life and innovative ideas for business world, including the quality journeys of overseas organizations will be introduced. Attendance is essential, for project-based leading is realized. It is mainly open to all students who will be leaders of the future in any field.*

<u>*Course Contents:*</u>

- *Introduction*
- *Defining Quality, Personal Quality & Leadership*
- *Main pillars and principles of Total Quality in Education & and goals: Strategic planning,*
- *Organizational culture and climate*
- *Leadership in 21st Century: Discussion on the Big Picture*
- *Innovation, innovative and innovativeness: Sample cases from Turkey.*
- *Qualities of effective leaders/teachers*
- *"Challenged students in Turkey and in the world".*
- *Developing team work and circles at work.*
- *ICT Sample projects from Turkey, India, USA and some other European countries (Leadership, Marketing, Career Portfolio).*
- *Human Dignity & Humiliation Studies for future leaders.*
- *General Evaluation.*

Required and Suggested Readings and also evaluation part will be shared upon request. The reflections and outcomes of the course will be shared during the presentation.

Some Final Words…

Teachers are confronting with challenging circumstances today. An increasingly diverse student population, rapid changing educational systems, problems in teacher training policies and adaptation problems of people to ever-changing technology are only a few of the main problem areas. The solution lies in education. School partners must walk arm in arm within the difficult path of education and technology. The innovative use of technology in education can add support to teachers working in teams. Collaborative projects may bring the joy of learning and sharing to students. Parents might take part in them to see what is going on in the educational world. Business world and media might catch some small but effective applications in various places. School directors might exhibit a real school leadership to combine all.

As a final remark, it can be said that; "Innovations are valuable and effective according to how wisely they are used, and how well they are taught to be sued for the future use."

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Education for All Children[1]:
Countering the Challenges through Teacher Education

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Abstract
The Education for All goals and the Millennium Development Goals have together underlined the primacy of educating children for the attainment of allied goals of human development. The achievement of all educational goals in general, and Universalization of Primary Education (UPE) in particular, depends largely on the preparedness and responsiveness of teachers to address various challenges. The present paper foregrounds the need for quantitative and qualitative capacity building vis-a`-vis teachers to pursue UPE. Further, it attempts to establish that whereas both the issues must be addressed to ensure that all children have an access to quality Education; they pose undeniable challenges to Teacher Preparation Programs. It suggests that whereas the issue of quality can be addressed by intensive teacher preparation interventions; equipping teachers to augment their pedagogical repertoire with Technology enabled education can be offered as an answer to the issue of Quantity. The present paper contextualizes the twin issues of quantity and quality to reflect the specific challenges faced by the UPE India chapter. The paper further aims to address the specific challenges that confront Teacher Education Programs in India as it pursues the aim of Universalization of Education for Children.

1. Introduction.

Education of All is a prerequisite for global development. This acknowledgement is iterated in the UNESCO initiatives on Education for all (EFA) and UN Millennium Development Goals (MDGs),as well. While Universalization of Education at all levels is the end aim; both EFA goals[2] and MDGs[3] have supported Primary Education as a prerequisite for achievement of other goals.

As the thematic paper on MDG 2 puts it; Primary education is a powerful driver for the realization of all the Millennium Development Goals (MDGs) and for sustainable development, more broadly [1]. Various UN policy documents have referred to Primary education as 'a basic human right, both transformative and empowering'. It is seen as a means for accessing broader social, economic, political and cultural benefits.

As a result, Universalization of Primary Education has been in global focus since 1990. The progress towards UPE has been encouraging; but not all challenges have been surmountable. Efforts to achieve UPE continue under the twin aegis of EFA and MDGs.

1.1 **EFA, MDGs and the Universalization of Primary Education.**

The Education for All (EFA) movement is a global commitment to provide quality basic education for all children, youth and adults. [2]

EFA movement was launched at the World Conference on Education for All (WCE) in Jomtien, Thailand (5-9 March 1990). The WCE was attended by delegates from 155 countries and representatives from over 150 governmental and non-governmental organizations. The participating delegates adopted a *World Declaration on Education for All*; which reaffirmed the notion of education as a fundamental human right. With regard to Primary education, it resolved,

"(*Goal 2.*) *Universal access to, and completion of, primary education (or whatever higher level of education is considered as "basic") by the year 2000."[3]*

However, the EFA targets were not achieved by the year 2000. The international community then met again in Dakar, Senegal at the World Education Forum(WEF), and affirmed their commitment to achieving Education for All through six well defined educational goals[1] by the year 2015. Of these six goals, goal 2 focused on Universalization of Primary Education. It read as,

"*Ensuring that by 2015 all children, particularly girls, children in difficult circumstances and those belonging to ethnic minorities, have access to, and complete, free and compulsory primary education of good quality*." [4]

The UNESCO World Education Forum, 2000 coincided in year and mission with the UN Millennium Summit held in New York at the turn of the century. The attending delegates adopted the Millennium Declaration [5] and set eight Millennium Development Goals (MDGs) pertaining to eight areas identified as most critical for human development [6]. Of the eight MDGs, MDG-2 specifically focused on education of children and lent support to the second EFA goal. MDG-2 spelt out as Target 2.a resolved to:

Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling.

The UN-MDG-2 and the second of the EFA goals are both geared at the achievement of Universal Primary Education (UPE). UPE implies that every child is enrolled in and completes full cycle of primary schooling.[7] As fundamental and laudable this aim is ,its achievement has been fraught with challenges which even the sustained efforts of world bodies like the UN, World Bank and UNESCO have failed to address fully since the Dakar and Millennium summit.

2. Universalization of Primary Education: Global Trends and Challenges.

The Overview section of the *EFA Global Monitoring Report 2012* (EFA-GBM) begins with the following observation; "Unfortunately, this year's EFA Global Monitoring Report shows that progress towards many of the goals is slowing down, and that most EFA goals are unlikely to be met. The report goes on to add, "On current trends, the goal of universal primary education (UPE) will be missed by a large margin…" [8].An analysis of the data and statistics provided by

EFA-GMR 2012 highlights that though some laudable progress has been made in the last two decades, the progress has neither been consistent nor universal. To illustrate, though the number of primary school age children out of school has fallen from 108 million to 61 million since 1999, but three quarters of this reduction was achieved between 1999 and 2004. Between 2008 and 2010, progress stalled altogether.

In 2010 twenty-nine countries had a net enrolment ratio of less than 85%. As many as 68 countries are far from achieving Gender parity in education and girls continue to be a disadvantaged group in as many as 60 of them. The disparities are also evident in the investment patterns of rich and poor households in education. Not only do the rural/ urban and gender disparities mar our attempts to meet the 2015 deadline, newer challenges are being thrown at us even as children enroll in or subsequently pass out of primary schools. Three pertinent challenges that demand immediate redress are;

- Ensuring completion of Primary Education Cycle,
- Strengthening infrastructure and capacity building initiatives for secondary schools and
- Improving the learning environment and quality of education.

The above listed additional challenges have only made the journey towards universalization of education for all children more difficult. Neither progress nor lapses have been consistent and universal. Serious lapses and delays are witnessed with respect to the countries with limited or deficit resources. As countries across the globe are not at par either economically, technologically or in their historical commitment to the goals of universalizing education, their journeys too have not been equitable thus demanding idiographic analyses. At this point we take up the case of India which, in addition to the challenges outlined above, faces challenges that are specific to it.

3. Education for All Children (EFAc): The Indian Chapter.

The commitment to Education for All Children till the age of 14 years is at least a century and a half old. These 150 years have seen India as a British Colony, as a country fighting for Independence; as a fledgling country finding its feet post-independence and finally as a neo-liberal economic and human resource powerhouse getting recognition on the world stage. The economic and political transformations have subtly transformed the vision of and methods for attainment of EFAc, too. These transformations have thrown up new challenges and newer solutions, too.

3.1 EFAc: Historical Context.

The recorded history of Indian commitment to Universalizing of Education in general and for children in particular dates back to the pre-independence India of 1911 when Gopal Krishna Gokhale introduced the “Free and Compulsory Education Bill” to the then British rulers of India. The bill was however shot down for various economic and political reasons.[9]

With the attainment of independence from the British *Raj,* India renewed its commitment to the Universalization of education through its Constitution in 1950. Article 45 of the constitution (under the Directive Principles of State Policy) stated that; “The state shall endeavour to provide within a period of ten years from the commencement of this Constitution for free and compulsory education for all children until they complete the age of 14 years."[10]

It must be iterated that inherent in Article 45 was the concern for Early Childhood Care and Education (ECCE for children up to 6 years of age) as well as for elementary (not primary!) education (i.e. eight year of education for children from 6-14 years). Further, it provided for Free and compulsory education of all children to be financed by the state. These provisions surpassed the later expectations of both EFA and MDGs w.r.t the Universalization of Primary Education for children.

Therefore, whereas the Jomtien Declaration and the MDGs would later require commitment to Universal Primary education; India since independence was aiming at Free and Compulsory EFAc (0-14 years).

40 years later with the Jomtien Declaration in 1990, the international community agreed to settle for lesser aim. The following decade (1990s) saw the waves of liberalisation hitting the Indian shores. Among other things, it paved the way for international funding agencies in the policy discourses on Education,. The dilution of the Indian ideal of Universalization of EFAc up to 14 years of age was accelerated by their arrival.In the subsequent years two large scale programmes sponsored by World Bank; i.e. District Primary Education Programme (1993- 2002) and *Sarva Shiksha Abhiyaan* (2000-2010) were adopted with the intent of meeting the projected levels of EFA and MDG-2 and focusing on Primary Education.

The primary education led agenda hailed by the international community first in Dakar and then in New York, led to an amendment in the Indian Constitution which entailed a raging debate that still continues. The 86th amendment (2002) reads;
Article. 21A. The State shall provide free and compulsory education to all children of the age of ***six** to fourteen years* in such manner as the *State may, by law, determine*.

This amendment led to the expulsion of children from 0-6 years of age from the ambit of states responsibilities. Further, it allowed for idiosyncratic implementations by state government and funding stakeholders.

To comment on what was finally borne out of this systematic dilution of educational aims the following observation will suffice: it has been over 60 years since the constitution was adopted by India and over 20 years since the WCE-Jomtien declaration on EFA; yet till date more than half of the Indian children falling in the age range of 6-14 continue to be deprived of eight years of elementary education (Class I-VIII). A multitude of reasons may be furthered to explain this anomaly; the subsequent section tries to identify the most pressing of them.

3.2 EFAc: Targets met and challenges faced

Measured by the quantity-centric indicator of Net Enrolment Ratio (NER) India is set to attain the target of Universal Primary Education before 2015. As per District Information System on

Education (DISE) statistics, India's NER in the years 2008-09 and 2009-10 was 98.6% and 98.3% respectively. As a result, India is likely to achieve 100% NER for girls and boys alike ahead of 2015.

However, India's progress story is uniformly marred by the three-fold challenges discussed in the previous section. The subsequent section attempts to understand these challenges ads they manifest globally and with special reference to India.

1. **Ensuring completion of Primary Education Cycle** i.e. improving Global Completion Rate of Primary Schooling (GCR-PS). Both EFA-2 and MDG-2 categorically comment on the importance of completing the cycle of primary schooling. However in reality, striking contrasts are seen in terms of the global primary completion rate (measured by the gross intake ratio to the last grade of primary education) [11] with regional values varying from 70 per cent in sub-Saharan Africa to almost 100 per cent in Latin America.

With specific reference to India, the encouraging NERs notwithstanding, the Completion Rate presents a sorry picture! In 2008-09 the CR was 76% as against the NER of 98.6%. On a more basic level, whereas as per the ACER-2012 survey the enrolment rate is 97%, the daily attendance rate is only 71%. The lapses in attendance have direct implications for the loss of learning opportunities as well as opportunities to experience success later on.

The reasons for the variations in NER and CR range from policy and implementation challenges to financing and capacity building challenges. It is interesting to note that the lack of external financing in some cases is not as binding as the constraints imposed by lack of capacity or the policy framework [12].

2. **Strengthening infrastructure and capacity building initiatives for secondary schools**.

Globally, with more children completing primary education, the demand for secondary education is growing. In 2010, there were 71 million young adolescents (typically aged 12-15 years) out of school around the world. Of these, around 48 million lived in countries where lower secondary schooling is officially recognized as part of the compulsory education system.

India is one such country; it aims at Universalization of Elementary Education, but the secondary school system in India is currently not geared up to handle the inflow of primary school pass outs projected for 2015 and also to retain them thereafter. As per the Ministry of Human Resource Development data the NER in secondary Education was a mere 52.26% in 2005-06. According to the National Family Health Survey (2006) for the respective NAR/NER values of 69 % at the primary school level among children from poor families, the NAR at the secondary level is a dismal 29%. Similar disparities are observed with respect to gender. [13]

In view of the disparities in Primary and secondary NERs, it is imperative that secondary schooling too is prioritized. To focus on primary education is not to ignore, overlook or undermine the other levels of education. Primary education is at the same time an indispensible tool of initial empowerment as well as a feeder system for lower secondary schooling. Further, the assurance of availability of secondary schools after completing primary education increases the incentive to complete primary school. Though the Universalization of Secondary Education has not been explicitly included in the EFA goals or MDGs, an expansion of secondary education significantly contributes to the expansion of primary education. Hence, it is important that initiatives aimed at primary education are augmented by an expansion of secondary education; so crucial to sustain the gains made by any surge in Global primary Completion Rates.

3. **Improving the learning environment and quality of education**.

Evaluations and assessments carried out under Global Monitoring of EFA goals have shown that children in many of the world's poorest countries can spend several years in school without learning to read a word. The Indian scene is no different; while 100 percent NER in primary schools is an interesting statistic, it becomes meaningful only if quality of learning can be ensured. The latest Annual Status of Education Report (2011) for rural areas indicates that 31.4% of class 3 children cannot read words in their own language. And 70.1% of them cannot solve a 2 digit subtraction problem. Similarly, 51.8% class 5 children cannot read a class 2 level text and 72.5% of them cannot do a simple division problem.

EFA-GMR identifies the quality (or the lack of it) of the teachers as the reason behind such shocking findings. Globally too, it has not helped that unlike EFA goals, the MDG-2 is firstly silent on the issue of quality of education and secondly equates education with schooling. The push in MDG2 for quantitative Universal Primary Education (UPE) has resulted in increased class sizes thus worsening Pupil Teacher Ratios (PTR) and negatively impacting quality of students' learning .

To conclude, India seems to be cruising swiftly towards the target of EFA 2 and MDG-2 if Net Enrolment ratio is taken as an indicator, but there are serious reservations on the aptness of NER as a true indicator. If NER is taken at face value, there is no challenge left and complacency can be welcomed. However, the true challenges continue unattended as discussed above.

A closer analysis reveals that each of the above challenge at the same time arises from, and has its solution in, the state of Teacher Education interventions. Thus looking for a solution to each one of them mandates that we focus our attention on teachers and teacher preparation as well.

- To illustrate, Completion Rate is threatened by the staggering number of students who drop out without completing the Primary Education Cycle. Apart from geographical hardships and financial constraints, girls and boys are also known to drop out because of the school environment, including experiences with teachers. As the *Thematic paper on MDG-2* points out, "…Despite the impact of any continuing economic and social constraints, once children are in school the decisions around whether to continue attending and the amount of learning which takes place depends largely on the teachers and the quality of classroom instruction." [1] Teacher attitudes go a long way in offsetting gender and socio-economic class based disadvantages once the students are enrolled for schooling. Similarly, the differences in learning styles between boys and girls though are less significant than the similarities, teachers if cognizant of such differences if and where they exist, can adjust their teaching and assessment methods accordingly and create conducive learning environments.

- The challenge of expanding Secondary Schooling to absorb the students finishing their primary schooling is partly a challenge about training the required number of skilled teachers. A lack of trained teachers, presents a major obstacle to achieving the EFA/MDG-2 goals. Presently, we have failed to manage the number of teachers needed to universalize primary education. The latest estimates suggest that 112 countries need to expand their workforce by a total of 5.4 million primary school teachers by 2015. In India alone, 523,000 teaching positions are vacant. Ensuring favorable teacher-pupil ratio and universal access to primary education in India requires an additional 510,000 teachers over and above current vacancies. In such a scenario, teacher recruitment for secondary schools is not even on the Indian radar yet.

- Finally, the issue of quality of education too needs a discussion on the number and nature of teachers engaging with UEE. Well-trained teachers are the single most important factor influencing the quality of children's early learning. Most countries have seen an enrolment boom in the last two decades which is not commensurate with the number of trained teachers available with them. One measure adopted by many countries in order to counter the ever bludgeoning teacher-student ratio is hiring Para-teachers. In Indian government schools as many as 12.76% of all teachers are actually para-teachers. These Para-teachers are typically secondary school dropouts from the local communities. As many as 49.8% of all Indian para-teachers are higher secondary pass outs or even less. Governments(whether Indian or otherwise) hire them as an emergency measure but may or may not provide them with even short-term training and support. Lack of systematic teacher training severely stunts the quality of Education in the long run.

  Another measure of quality of education is the school teachers-pupil ratio. As per 2006-07 DISE statistics, the pupil-teacher ratio across all Indian states is as unfavorable as 39.21. We have not fared well on the teacher pupil ratio, globally. .

  An acknowledgment of the challenges staring us in the face and the additional realization that each of these challenges mandates a sustained availability of well trained teachers instantly shifts the spotlight on Teacher preparation programs; it is time then that candid and sustained discussions are carried out on the role and mandate for Teacher Education Programs(TEP) for achieving the goal of quality Education for all children.

4. Teacher Education for EFAc : Issues and Challenges

The challenges to EFAc mandate two-fold efforts at capacity building. Firstly, it requires an expansion in the sheer reach of learning resources; human as well as material. Secondly, EFA entails large scale engagement of Teachers with basic skill set to provide quality education to learners. The first dimension is being probed enthusiastically, and technology has given us answers on expanding reach and ensuring accessibility. The second challenge though more basic has been more difficult to address.

The unparalleled might of technology in terms of ubiquity can be gauged from some basic data.
For the first time in history, there are more mobile phones and tablet computers on the planet than there are people. There are over 3.2 billion unique mobile phone subscribers world-wide, making mobile phones the most widely used interactive ICT on Earth.

The Indian scene is equally encouraging. Mobiles, Computers and Broadband services have stormed the Indian subcontinent. As per census 2001, there are 5,93,731 inhabited villages in India. At the end of June-2011, 98.1% of the total inhabited villages in India have been connected by technology. Mobiles are the preferred technology for communication with the popularity of wire line access declining. Total Wireless (GSM + CDMA) subscriber base registered a growth of 4.94% in the second quarter of 2011 alone. Over a period of 12 years, internet subscriber base had increased by 97 fold from year 1999 to 2011.

Despite their ubiquity in India and given the unique types of learning they support, these technologies are ignored in formal systems of education. The fact that ICT and mobile learning technologies; in particular, have advantages of geo-spatial and temporal flexibility should contribute to their popularity as a mode of learning-teaching. The added benefit of no additional infrastructural costs can make them particularly useful in developing countries like India.

However, till the teachers are educated to harness the pedagogic potential of these technologies, there educational value not be realized. Thus, a shift to technological augmentation of teaching learning strategies mandates a change in the way we approach teacher preparation.

UNESCO, which has been particularly active in spreading a positive word about the potential benefits of use of ICT and Mobile Learning Systems, too realizes that a movement from wholly traditional classroom to an eclectic mix of face to face and ICT based teaching would necessitate a discussion on teacher preparation beforehand. UNESCO's research has shown that without guidance and instruction teachers will often use technology to 'do old things in new ways' rather than transform and improve approaches to teaching and learning.[14]

Yet another challenge to teacher education is posed at a more basic level. Pursuance of the goal of EFAc entails large scale engagement of Teachers with basic skill set and aptitude to comprehend and address the distinctive challenges of the learner groups. Whereas technology has the potential to ably play an assisting role, the primary role is to be donned by teachers. Before they can be tech-savvy teachers, they need to be just that; 'teachers'.

Thus the re-envisioning of teacher Education is to be informed by two concerns;
Firstly, the need to prepare 'enough' teachers who can comprehend, appreciate and address learner diversities in all its manifestations to ensure quality education and conducive learning environments. This entails addressing the issue of quantity as well as quality of teachers. Secondly, to prepare teachers who can seamlessly integrate technology in pedagogy and assessment and do so consistently.

5. Teacher Education for EFAc : Blueprint for Capacity Building.

At the outset, nomenclatures have the potential to direct our thoughts. Whereas, the phrase Teacher Preparation connotes a sense of 'readiness', the term Teacher Education connotes 'enabling' for future. Preparation is deterministic in that it readies one for definite situations and inculcates a fixed skill set to handle expected contingencies. Education breeds perspectives and unearths worldviews. To be Educated is to be empowered. It subsumes the capacity for transfer of learning and perspectives to newer situations and unexpected challenges. In this sense, then the role of Teacher training is to prepare a teacher with the ability to customize and create rather than to follow convention.

5.1 Addressing the Quantity and Quality Deficit through Teacher Education

Teacher Education is both a noun and a verb. As a noun it denotes a systemic provision; as a verb it implies an experience. These twin conceptualizations in conjunction can address the quantity and quality deficits that impediment our move towards EFAc.

At the systemic level Teacher Education has to expand to generate the required number of trained teachers. To this end, Public-Private Partnerships(PPPs) must be mobilized to ensure that Teacher Education is expanded without discounting quality. More teacher training institutions need to be established. Existing Teacher Education Institutions need to operate at optimum levels. Multi-modal programs must be introduced with a strong theoretical component that can be transacted virtually. Though there is no substitute to field training, technology needs to be used unapologetically to augment the hands-on training that teachers receive as part of the practical work they undertake. This can include virtual exposure to varied learner contexts and cohorts. Quality Management of all Teacher Education programs must be prioritized.

An equitable emphasis is to be laid on the provision of quality In-Service Teacher Education (ISTE) Programs. Benefits of ISTE include reception of new information, practice of new methods of teaching, learning to develop new teaching materials and peer-learning through sharing of experiences of classroom problems and successes. In-Service Teacher Education must compulsorily include research components. As it is, there is a need to undertake more studies to understand the dynamics of learning in Multi-grade, multi-age and multi-ability classroom settings.

Another way of addressing the issue of numbers is to arrest teacher dropout rates and facilitate teacher retention. An earnest social dialogue with teachers can significantly enhance the ownership, implementation and success of policy reforms and field initiatives. In addition favorable salary structures, efforts to leverage social status of teachers, respectful working conditions and a two way open channel of communication are some other factors that can promote teacher retention and address the issue of quantity to a reasonable extent.

While addressing the issue of quantity is important; simultaneous efforts are to be made to address the quality dimension. Teacher Education Programs must equip teachers to comprehend, appreciate and address learner diversities in order to ensure quality education and creation of environments which are conducive to learning.

As a Teacher Educator the author has always believed that in order to produce quality teachers a Teacher Education Program must begin by cognizing some fundamentals about the learning–teaching process and subsequently structure its content around these fundamentals.

- **Fundamental to the teaching-learning process is the nature of the Learner and the teacher.** Learners differ in their life experiences which result in differences in personality and learning styles. Most surface differences among the learners could be traced, with some effort, to a more fundamental level i.e. the life events of such learners. As an individual, a teacher too is a product of her context. Though this contextual identity pervades our existence, in case of a teacher it is seldom cognized and rarely challenged. For a learner however preserving this identity may be a challenge in itself.

A successful teaching-learning relationship demands mutual understanding and collaborative partnership between a teacher and her student. Mutual understanding may be initiated through, though by no means guaranteed by, trying to understand each other's nature and context. Collaborative partnerships are the next step. In a country like India where most of the target learners in the rural belt are first generation learners, the need for a collaborative relationship between the teacher and her learner assumes un-paralleled importance. In first generation households parental scaffolding in academic domain is a serious casualty. Thus in the context of EFA the importance of Collaborative Partnership cannot be over-emphasized. The preceding discussion has profound implications for Teacher Education Programs. These programs have to prepare teachers who are inclusive, reflective and analytical. They have to be child-centered rather than teacher centered; they have to be context-centered rather than content-centered.

- **The classrooms today are multi-cultural, multi-lingual and essentially heterogeneous.** Classrooms are living microcosms that replicate the structure and dynamics of society outside their walls. Classrooms would have regional and linguistic factions. They would have Gender as an embedded theme. There would be socio-economic divides waiting to get reinforced. A teacher may unwittingly become a re-enforcer of factions if she is not aware of the complicated rubric of a classroom. Teacher Education Program must instill a discerning attitude and inculcate sensitivity towards this heterogeneity. To enable a teacher to handle these diversities, teacher education curricula must foreground diversity in its discourse and introduce responsive and inclusive pedagogies. Yet at another level a teacher must be educated as an agent of social change. She must facilitate socio-psychological mobility of her learners above and beyond the sociological categories of gender, class, region etc. The readiness for such psycho-social mobility comes as a result of critical pedagogy and inculcation of life-skills. A Teacher Education Program envisioned to address, among other things, the EFA challenge must weave both Life-Skills and critical pedagogy in its curricula.

- **Education is for Empowerment.**

The emancipatory potential of Education is best comprehended against the backdrop of Millennium Development Goals. Education is empowering in that it bestows the knowledge and skill set to interact meaningful with the world around us in all its complexities. The improved quality and effectiveness of education rests on the re-examination of the purpose of learning and the revisiting of what can be expected through education pedagogy, a gender-sensitive and culturally relevant curriculum, and a broad learning environment.

This perspective when adopted would transform the way a teacher looks at her role in the classroom as well as the entire educational process. The rigidity of curriculum and perspectives on 'Knowledge' would be incessantly questioned. To rise up to the challenge, Teacher Education Programs must incorporate the themes of contextual learning, Situated Cognition and Education for problem-solving. For a teacher so trained Education would become a lived reality rather than a read/ studied reality. Such an Education would give the youth of tomorrow a voice to ask for their right to a dignified life; which is the mission of both EFA and MDGs.

- **Assessment is a means; never an end.**

Once the above stated fundamentals are understood, the concept of assessment too undergoes a metamorphosis. Teacher Education Programs must prepare teacher with a revolutionary understanding of Assessment.

Any meaningful assessment can be done no other way but in an idiographic manner. Norm-referencing is passé. One-test-fits-all has lived its life. Summative assessment may be of enrichment value, but the primacy is to be given to formative assessment. Assessment can no longer be a stand-alone exercise. It must precede, accompany and succeed all learning experiences. More importantly, assessment methods must cognize the contextual and linguistic barriers to learning as well as performance. It must take into cognizance the nature of teaching learning materials used and the mode of instructions utilized. Then again, Assessment has to be participative. The learner must be a continuous and active partner in designing and evaluating learning experiences. Lastly, assessment must be cyclic in nature. If Education is for Empowerment, assessment can only be to strengthen the process of empowerment. It can no more afford to have a selection-rejection orientation.

Above and beyond the traditionally rooted-for skills, if a Teacher Education Program can sensitize teachers towards the nature of their learners, get them to consistently discern and respond to learner diversities, see Education as the end of which assessment is a mere means, chances are that learner dropout rate would be significantly arrested. A teacher so educated would be able to achieve the twin objectives of creating positive learning environments and nurturing quality educational experiences among her learners. Once an array of such teachers is in place technology can be used to widen their reach in terms of students accessibility and learning resource generation. This brings us to the second concern, namely, to prepare teachers who can seamlessly integrate technology in pedagogy and assessment and do so consistently.

5.2 Addressing the Quantity and Quality Deficit through Teacher Education

As discussed previously, the advent of ICT and Mobile Learning Systems (MLS) has been keenly watched for their potential to improve educational equity by introducing new pathways for learning and improving existing educational offerings. Though the use of such technological augmentation is very limited, wherever it is indeed being used, these projects do not replace but rather complement existing educational investments such as textbooks, infrastructure, hardware, training and content.

Given the astounding levels of projected penetration of various mobile devices, the integration of ICT etc. in pursuance of EFA is more a compulsion than choice. As a result various Governments facing the fast approaching deadlines to meet EFA targets would ensure that Teacher Education Programs too incorporate ICT-MLS as compulsory curricula sooner rather than later.

The introduction of ICT-MLS has unique advantages when compared to traditional forms of teaching [15]. To exploit the potential of the booming technology it is imperative that Teacher Education Programs, too, integrate it in their curricular structure as well as operations. In this process some teachers may need bridge courses or workshops and /or orientations to the technical aspects of ICT-MLS. A Teacher Education Program must make provision for such refreshers/ workshop courses for both Pre-Service and In-Service Teachers.

Once a reasonable degree of comfort is achieved in handling ICT-MLS, priority is to be given to educate teachers in the use of ICT-MLS to transact subject specific contents. Teachers must be made aware of and receive hands on training in designing ICT-MLS informed pedagogies.
The Teacher Educators may themselves exhibit illustrative usage of ICT-MLS as they transact the Teacher Education Curricula with trainee teachers. Specific modules in teacher training as well as content related to continuing professional development can be designed and made available through ICT-MLS.

Once in Field ICT-MLS keeps the channels of academic communication open. Specific teacher-centered resources can be made available by Teacher Education Programs. Teachers educated in the usage of ICT-MLS can forge a learning community transcending geographical boundaries and create a meaningful discourse on field related problems, learning therefrom and innovative solutions tried by them.

Teachers in field can use ICT-MLS to regulate and reinforce content learning among their students. It also provides a platform for cultural and academic exchange among various learning cohorts provided the respective teachers take the initiative and facilitate such an academic exchange.

ICT-MLS can be of immense use in the field of assessment as well. Teacher Education Programs must also educate their trainee teachers to utilize the potential of ICT-MLS for creating elaborate learner portfolios, keep them updated, share them with the intended learners and their families and use them to track the learning curves of the learners across disciplines and skills. ICT-MLS with the potential for providing geo-spatial location services, personalization of user interfaces, multi-media and multi-tasking abilities, communication services, ubiquity and economy are the much awaited ally to help teachers counter the specific geographical, temporal and financial impediments to EFA. However to be able to utilize technology in the pursuit of EFA teachers need capacity-building efforts that are thorough and consistent. It now rests on Teacher Education programs to partake of the responsibility.

6. Conclusion:

Inherent in every problem is the possibility of a solution. The fact that most countries are set to miss the EFA deadline of 2015 gives us an opportunity and a reason to re-evaluate the aims we have been pursuing. In doing so, there are at least three lessons to be learnt from the Indian constitutional commitment to EFAc.

Firstly, the global community must reposition EFAc (0-14 years), instead of Primary Education (6-11 years) as the aim. Secondly, '<u>Free</u>' and compulsory Education must be stressed instead of compulsory education alone if we truly want to extend the benefit of the attempts to Universalize Education to the farthest sections of society. Finally, unlike MDG-2, both the Indian constitution and EFA goals focus on Education and not schooling; that there is a difference between the two has been amply proved by the increasing Net enrolment ratios on one hand and the declining levels of learning on the other. Therefore quality of Education must be ensured and NER must not be considered a primary indicator of success.

Finally, it must be acknowledged that teachers are the fulcrum of all educational interventions. The nature of the teaching-learning process is such that any improvement in the quality of teachers would result in an exponential effect on the quality of learning and in longer run; the learners. Quality teachers have the potential to change the world. Given that we live in a world that is awaiting change, this potential must be harnessed on priority. Teacher Education programs can expedite such change by quantitative and qualitative capacity building. Technology can ably support such efforts at capacity building. A sustained effort is to be made to incorporate technology enabled learning in, and tailor-made, teacher education programs to reflect and support the aim of Education of All Children.

Endnotes:

1. The phrase 'Education for All Children' is taken from Article 45 of the Constitution of India wherein it is stated that; "The state shall endeavour to provide within a period of ten years from the commencement of this Constitution for free and compulsory **education for all children** until they complete the age of 14 years."

2. The six EFA goals were identified as :

1. Expanding and improving comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children.
2. Ensuring that by 2015 all children, particularly girls, children in difficult circumstances and those belonging to ethnic minorities, have access to, and complete, free and compulsory primary education of good quality.
3. Ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life-skills programmes.
4. Achieving a 50 per cent improvement in levels of adult literacy by 2015, especially for women, and equitable access to basic and continuing education for all adults.
5. Eliminating gender disparities in primary and secondary education by 2005, and achieving gender equality in education by 2015, with a focus on ensuring girls' full and equal access to and achievement in basic education of good quality.
6. Improving all aspects of the quality of education and ensuring excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills.

3. The eight MDGs were operationalized and stated as:

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV and AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a Global Partnership for Development

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