

“Other” EdTech “Stuff” at MIT

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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.