# The Use of Technology to Build 21st Century Skills in Formal Education

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## Abstract

*Transformative changes have taken place in the world during the last decade due to the explosion of inter-connectivity linking people from all walks of life across the globe. Low-cost Information and Communication Technology (ICT) tools, especially, internet and mobile technologies are powering this wave of change. As a result, new skills and innovative abilities are required of students and workers in their learning, livelihood and life.*

*In the 21st Century, virtual learning, online discussions and tele-meetings are becoming basic requirements. This demands a workforce with excellent collaboration, communication and critical thinking skills. The challenge for formal education is to build these 21st Century skills through a blend of technology-powered learning experiences throughout a student's education.*

*The Author has drawn this from over 25 years of experience in non-formal IT education using blended delivery methodologies to explain how the education systems and the workforce in India and other Asia Pacific countries have evolved. During this period, he was also involved in building partnerships between industry and tertiary education institutions to reduce the IT skills gap in the rapidly growing business environment. In the last 4 years, he has been working extensively with Education Ministries, not for profit organizations and large schools in Asia Pacific countries to support the building of 21st century skills like critical thinking, collaboration and communication in primary and secondary schools using technology. From this experience, a number of recommendations are offered to propel education and learning towards a 21st Century model that will serve many students and workers.*

This focus of this paper is on:

- How businesses in the world are changing and what this means for education?
- How different 21st century learning is compared to 20th century learning and the stake holders in it?
- Some of the key barriers limiting the use of technology in formal education in Asia Pacific countries.
- The importance of 21st century skills in work-life and the ways they can be embedded into formal education using ICT.
- Why there is no one solution to address the complex, rapidly changing environment, especially in Asia Pacific?
- How a forward thinking residential school model is supporting students coming from semi-urban and rural areas to build 21st century skills powered by technology?

## 1. Introduction

The premise of this paper is that existing test-based education systems will not be able to produce the innovative, skilled work-force required in the 21st century, unless it changes course by incorporating Project Learning using technology as part of the formal curriculum.

Recent experience shows that many global organizations have started moving their businesses and knowledge-related activities to low cost countries. In Asia Pacific, large countries with English language fluency as a part of its formal education are benefitting the most. Some examples include the rapid growth of outsourcing businesses in countries like India and the Philippines, which have created huge employment opportunities for their youth. This form of rapid growth is changing their economic and social opportunities at an unprecedented rate.

In another shift, local businesses in developing countries are moving away from large cities to smaller locations due to the high cost of technical infrastructure, travel time and scarcity of skilled staff. The smaller locations with good IT infrastructure and skilled staff are benefiting from this change.

Currently, a population of around 1.5 billion attends primary and secondary schools globally, which is approximately 75% of all school age children. Though 1.5 billion students attending primary and secondary schools is a staggering figure, most countries find it challenging to provide learning opportunities beyond the basic curriculum designed to prepare students with traditional basic skills and a content-focused education; this is creating a huge gap between the demand for 21st century workers and the short supply of future-ready school graduates.

"... To be ready for the future, our children need to grow up as independent thinkers, with the habit of questioning and thinking for themselves. They need to be well-rounded in outlook and abilities, have good values, and be robust in the way they approach challenges and obstacles… They should be culturally-intelligent, able to understand the work well in global economy… ", Lui Tuck Yew, Minister of State, Ministry of Education, Singapore (16th Jan 2008).

Many governments implemented formal education in a **survival** mode during the 1960s and 1970s and were focusing their energies to build basic literacy and numeracy. In the 1980s and 1990s, the focus was on **competence** to build basic capabilities for graduating students to be productive in the workforce. In the 21st century, the focus on education has shifted to the **aspiration** level to maximize the employment of talent potential at the quickest pace through a more tailored education powered by Information and Communication Technology (ICT).

In recent years, governments are spending a huge share of their country budget and time to redesign their education systems with expert support from industry to help learners participate in the globalization process and help prepare students with the 21st century skills most needed, such as collaboration, communication, critical thinking and technology literacy.

## 2. Information Technology evolution and its role in the education system

Earlier, to support the changing needs of business, technology was introduced in formal education in a variety of forms, but was mostly focused on talented student groups in Asia Pacific countries. Now, it's becoming critical to use technology in education for all students and working populations to meet 21st Century business demands.

In the 70s and 80s, large computers were used in automation processes which created limited role-based jobs with specialized skills developed mostly during tertiary education. Two of the most common methods used during this period were Video Aided Instruction and Computer Based Instruction.

In the 90s, the personal computers held an important place in formal education as they likewise played a significant role in creating new job opportunities across the globe at various levels in business. This trend has resulted in a huge push to expand IT skills especially in secondary and tertiary education coupled with continued skill upgrading programs for the workforce. However, the benefits of computers were limited to a very few countries due to the high overall cost, and ICT literacy was offered only in selected institutions. Job creation was predominantly IT related which led to huge knowledge gaps among students in developing countries. Many product companies contributed to closing this gap by helping to integrate their product knowledge into the formal curriculum to ensure that students developed adequate skills before entering the job market.

Worldwide PC use has grown from 98m units in 1990 to nearly 1.1b systems in 2007 and is projected to top 1.78b units in 2013. To support the PC's penetration, many organizations adopted and adapted interactive Computer Based Instruction learning using multimedia technology to build the needed technology skills.

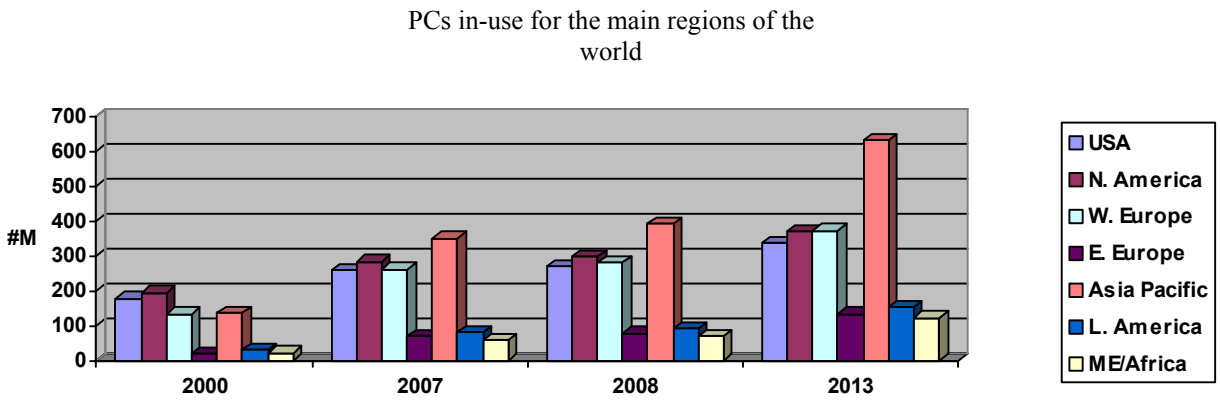


Figure 1. PCs In-Use by Regions in *millions* of units [1]

## 3. New learning balance

Now, students need to compete globally and they no longer have the luxury of learning communication, collaboration and basic technology skills separately. Ideally, they must possess all these skills by the time formal education is completed. This comprehensive learning is only possible through the expanded use of ICT in learning, as technology provides speed, consistency, access to quality content and subject experts. The following graphs illustrate the population vs. internet users which demonstrate the need to address the shortage of 21st century skills.

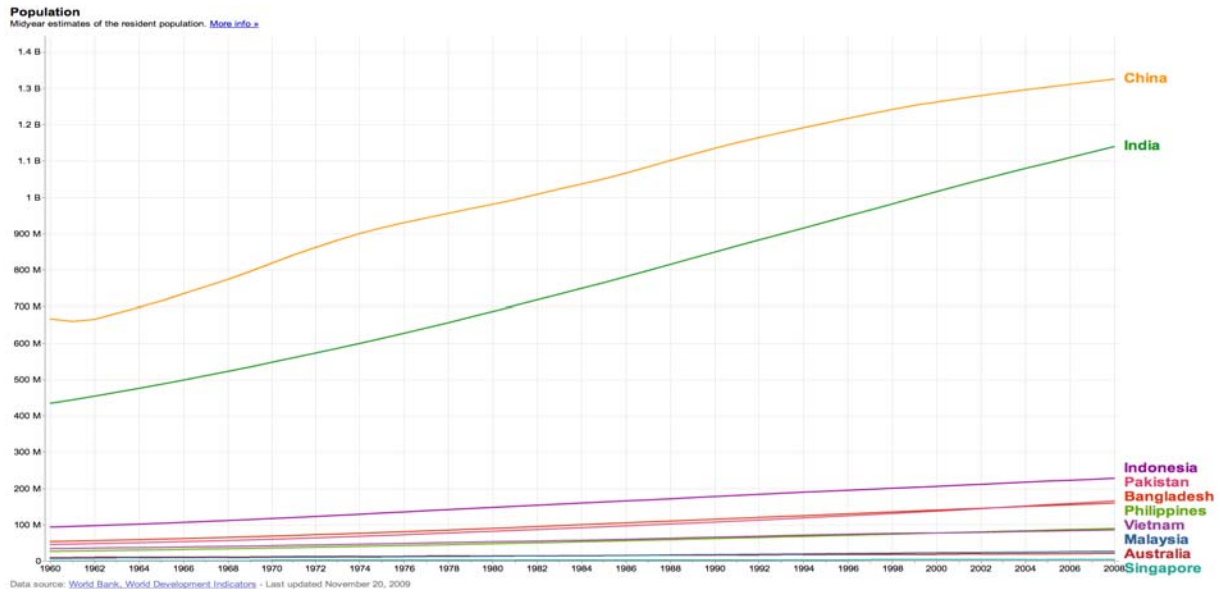


Figure 2. Population of some Asia Pacific countries [2]

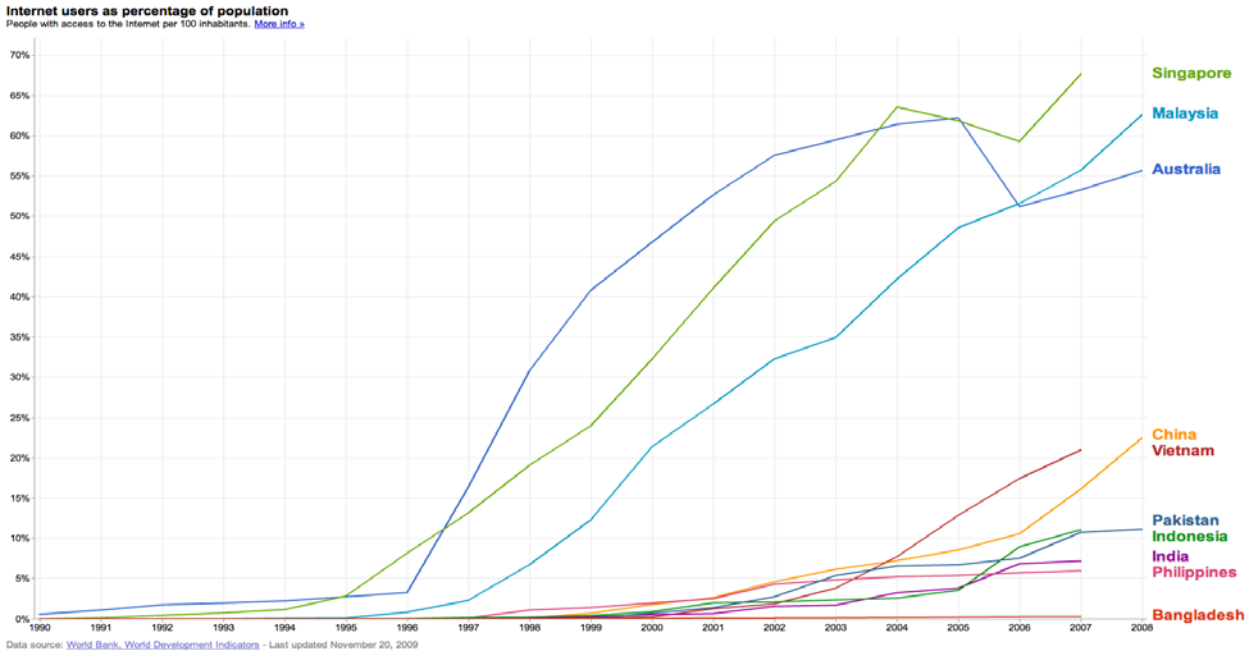


Figure 3. Percentage of some Asia Pacific population with access to internet [3]

Ministries and other educational agencies have started investing in the learning of technology skills in formal education and 21st century skills independently using different delivery models to ensure their students are equipped for 21st century jobs and are successful in the job market.

Ideally, the application of 21st century skills should be intertwined with conventional education practices. The framework below aims to highlight the importance of blended education, infused with technology use, rather than solely "chalk-and-talk" classroom curriculum learning.

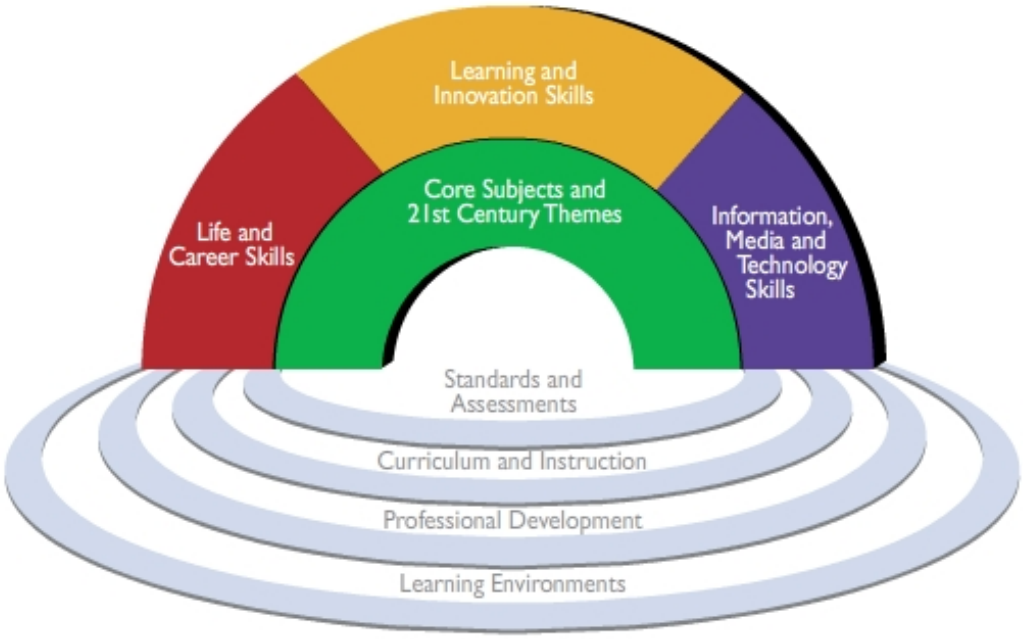


Figure 4. 21st century skills learning framework [4]

As the Figure 4 illustrates, the conventional modes of education should be bolstered with 21st century skills. The application of both 21st century skills and conventional education would lead to a more holistic learning approach.

With more widespread technology use, there is an ongoing transformation in society and also in formal education. If technology is powering this transformation, it's also a catalyst for building 21st century skills. There is a whole new architecture of thinking about learning evolving:

1. Learning is no longer a one-way information flow and now it's flowing through a network of diverse individuals and organizations. It is developing capacity for becoming self-reliant learners, which is critical for higher education's increasingly blended and self-directed learning methods.
2. Learning networks are promoting collective listening, dialogue and collaborative projects that prepare students for innovative teamwork that business now demands.
3. Technology is supporting the ability to be non linear thinkers with the capacity to work in less structured and more innovative environments.
4. Increased technology use is creating a positive tension among teachers and students to better deal with ambiguity and risk taking, leading to the realization that leadership is rooted in self-motivation and self-learning.
5. Technology encourages sharing of thoughts and a diversity of thinking that characterizes a 21st century creative knowledge economy. As students become more technically literate and connected, they are encouraged to think with the future in mind and to confront the issues of our times.
6. Connectivity provides access to resources that support the 21st century skills learning on a continuous basis through online teacher training, online curriculum and references, teacher managed student projects, online evaluation and feedback, etc.

While there are many key educational stakeholders like Ministries of Education, Non-Governmental Organizations, Foundations, and individuals in this transformation, teachers will have huge responsibilities for helping students develop 21st century skills, and they also need to be equipped with these skills. Some of the skills that they need to develop in today's changing balance are:

| From | To |
|---|---|
| Teacher-directed | Learner-centered |
| Direct Instruction | Interactive exchange |
| Knowledge | Skills |
| Content | Applied Skills |
| Basic skills | Applied Skills |
| Facts and principles | Questions and Problems |
| Theory | Practice |
| Curriculum | Projects |
| Time-slotted | On-demand |
| One-size-fits-all | Personalized |
| Competitive | Collaborative |
| Classroom | Global community |
| Text-based | Web-based |
| Summative tests | Formative evaluation |
| Learning for school | Learning for life |


Figure 5. New Balance in Education [5]

In the developing countries, the education system is closely guided by the government to ensure education improves the literacy rate of as many students as possible. Depending on the economic conditions, the local country culture, and the language barriers, countries are devising new models that better serve the educational needs of their citizens. As the rural population ratio is higher and shortage of trained teachers is acute in most Asia Pacific countries, access to quality education remains a challenge for children unless technology can bring education closer to them.

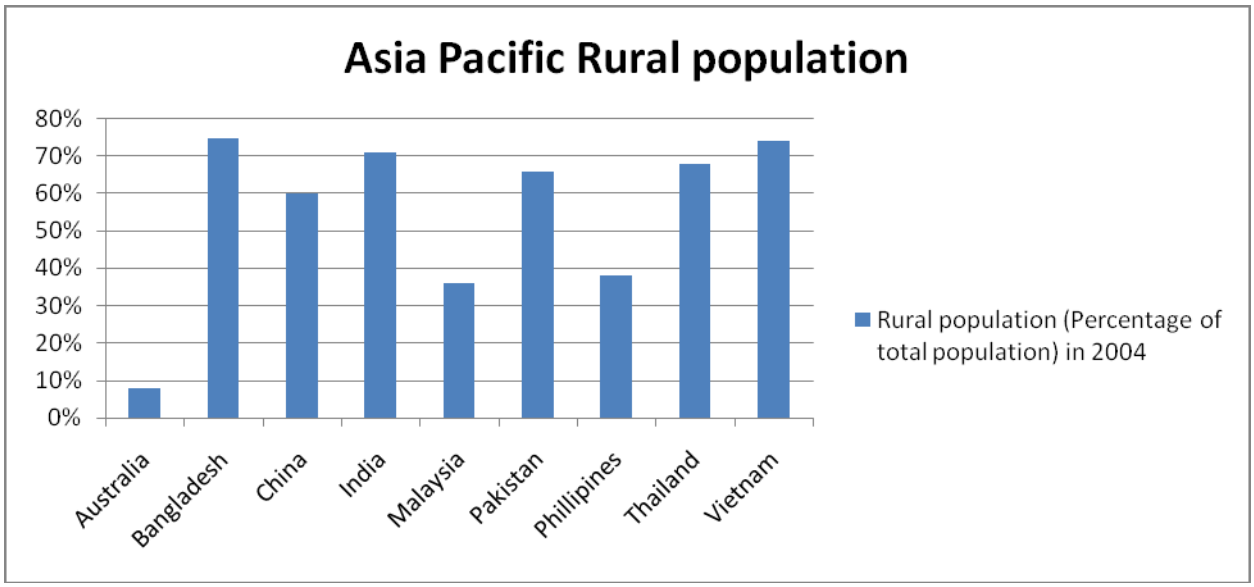


**Figure 6. Percentage of Population living in Rural Areas in some important Asia Pacific countries [6]**

The challenges students face during advanced phases of education and employment include the language of instruction in secondary school education and tertiary education (teaching is normally delivered in local language/dialects).

One example of an effective use of technology in education is the use of cell phones to learn English among students in Bangladesh. They realized good communication skills are vital to enhance their employment opportunities [7]. The wide use of current mobile technology by students has led to expanded learning opportunities at an affordable cost.

Another great example of technology use in schools is a unique educational model introduced by the Indian government in the early 80s through Jawahar Navodaya Vidyalayas (JNV) under Navodaya Vidyalaya Samiti (NVS) [8]. These are governed by the Ministry of Human Resource Development, India (http://www.navodaya.nic.in).

These schools provide good quality modern education including a strong component of culture, inculcation of values, awareness of the environment, adventure activities and physical education to talented children predominantly from rural areas. Currently, there are over 557 residential schools across most states in India providing education from grade VI till Grade XII (free till grade 10). These schools initiated many ICT programs by partnering with local and large global corporations to get access to the latest technology and teacher training with the objective of reducing the digital divide between rural and urban Indian populations by providing high quality learning environments powered with technology. While the teachers had the opportunity to learn Information Technology concepts through their other partnerships, the Oracle Education Foundation (www.oraclefoundation.org) introduced the teachers and students to a free and protected ThinkQuest Projects online platform which provides an opportunity for students and teachers to learn and practice 21$^{st}$ century skills using technology.

With a very humble start, NVS piloted ThinkQuest Projects in 2006 in some of their schools and started using this platform to communicate amongst themselves, eventually moving to build a number of real world projects with students.

This ThinkQuest online platform is used to develop student's independence as learners and problem solvers and build skills that can be applied to innovative situations that go far beyond the classroom environment.

Mr. Nageswara Rao, Deputy Commissioner NVS-Hyderabad Region has said, "ThinkQuest by Oracle Education Foundation is creating opportunities for collaboration, learning from peers and self-learning, which are key 21st century skills. Given the semi-urban settings of Jawahar Navodaya Vidyalayas, we are happy that technology has transformed our campuses into learning organizations."

While there are many examples of quality projects done using this protected platform by thousands of students (these can be viewed in the ThinkQuest library – www.thinkquest.org/library), the story of Radha, a first generation student attending a JNV school in India, shows how powerful learning with technology can be. She used the ThinkQuest platform in her school to build collaboration and research skills, and gained recognition in her village. In a seven minute video accessible from the Oracle Education Foundation website (http://www.oraclefoundation.org/single_player.html?v=4) [9], you can clearly see how Radha developed 21st century skills and how it changed her life. The learning opportunities and life-changing experiences that can be achieved if these skills are provided through formal education are made quite clear in Radha's story.

Mr. M.K Mishra, a JNV English teacher from Chhattisgarh, India shares his views on how his students who are using this technology as a part of their curriculum in their schools are benefiting:

"It has offered them the grit of leadership, innovative critical thinking (thinking things in a different perspective), and a marvelous style of working in a team, respect for the others, stupendous time management, and above them all, the zeal to excel others in their creativity. They have learnt confidence of doing independent work."

As NVS progressed in the use of this platform, some of the teachers, the key stakeholders from NVS were selected for a very intensive training program to learn advanced project based learning skills through Oracle Education Foundation's Project Learning Institute.

As G. Nageswara Rao, a JNV school teacher (and President Awardee) has said, "The Project Learning Institute is a unique experience of learning things from the real life, using technology for the enhancement of teaching. It may provide a strong bond between the teachers and students to bring them closer. Our rural talented children have experienced the effect of ThinkQuest Projects and are very happy."

## 4. Steps towards transforming formal education through 21st century learning

While many countries have realized the importance of changing their direction to incorporate 21st century skills, there is no single solution to address the current digital divide and lack of key skills for our times. Therefore, we need a collaborative approach to address this situation. The following steps are recommended while covering child safety issues where required:

1. The vast efforts of large corporations and non-profit organizations to address the needs for 21st century skills should be put together to avoid duplication of efforts and provide a powerful united force for change that Ministries of Education can use to ensure consistent implementation.
2. There should be an increased use of blended technologies like TV, Internet, mobile and digital media in formal education at all levels to ensure widespread, high-quality access to some of the best curriculum available for all sections of teachers and students.
3. Introduce Project Learning skills regularly in formal teacher training programs. Teachers' projects should be developed in a collaborative environment using technology.
4. Teacher networks and online communities are critical for success. Strong initiatives should be undertaken to ensure that teachers' skills are upgraded to support student projects using technology. Students' involvement in learning projects is essential to developing 21st century skills and should be evaluated through ongoing, formative evaluations that are part of the learning process.
5. As the Internet is key component, local Internet Service Providers should be approached to grant access to teachers and students at minimal cost. Where schools don't have quality access to the Internet, efforts should be made to provide access through community centers or public libraries with local government support.
6. Academic institutions with good IT infrastructure should be linked with primary and secondary schools and be encouraged to develop technology based projects for students. Qualified academic staff and students may be encouraged to provide guidance to teachers and students in schools that need support.
7. Introduce Project Learning into classroom curriculum for at least 2 hours per week with teachers evaluating learning projects like any other curriculum approach.
8. If the schools are using local language as the medium of instruction, involve teachers, locally or globally online, who are fluent in English as a part of the projects to help students to collaborate globally.
9. Students' social networking experiences should be leveraged to build basic communication and collaborative skills.
10. With the ongoing economic stimulation offered in various developing countries, it's a great opportunity for Education Ministries to raise the level of learning opportunity equality through ICT. This will help the students in tertiary education to deeply focus on the core concepts in the subject areas and use their 21st century skills to apply that knowledge to solving real problems to create a better world.
11. To support the students who weren't able to develop these critical skills in their early education, they should be provided with an accessible, technology based 21st century skills curriculum. This technology based curriculum should be supported by local facilitators to help students build skills essential to joining the 21st century workforce.

## 5. Conclusion

Internet technology is eliminating the boundaries in education and creating a flat learning world in the 21st century. Skills like communication, critical thinking, collaboration and use of technology are becoming necessities for students from all walks of life to step into this new world, hence, 21st century skills development needs to be a vital part of formal education at early levels of education. This will prepare students to further their education anywhere in the globe and gain the confidence needed to successfully step into the world of work and civic life.

## References


[1] Worldwide PC market by eTForecasts.Com

[2] Total population in some of the key countries in Asia Pacific, adopted from Nationmaster.Com

[3] Percentage of Asia Pacific population with access to internet, adopted from Nationmaster.Com

[4] & [5] Trilling, B & Fadel C, 21st century skills: learning for life in our times, Josey-Bass, 989 Market Street, San Francisco, 2009.

[6] Rural population (Percentage of total population) in 2004, adopted from Nationmaster.Com

[7] "In Bangladesh Cell phone English lessons a hit", AGENCE FRANCE-PRESSE, The Straits Times, Singapore, 14th December 2009, A10

[8] Navodaya Vidyalaya Samiti – Ministry of Human Resource Development, India

[9] Radha's story, courtesy of Oracle Education Foundation, Incorporated in 2008 Annual Report