Meeting the Education Challenges of the 21st Century

The National Assessment of Educational Progress (NAEP) assesses the reading, math and science abilities of students in grades 4, 8, and 12. At grade 8, the average NAEP mathematics score (reported on a scale of 0 to 500) increased 2 points from 2007 to 2009 and was *higher in 2009 than in any previous assessment year* (283 on a scale of 0-500). Source: Digest of Educations Statistics 2010 (pg.2, pg, 62)

NAEP uses a scale of 0 to 300 for reporting performance in science. From 1996 to 2005, the national average 4th-grade science score increased from 147 to 151, but there was no measurable change in the 8th-grade score, and the 12th-grade score *actually decreased from 150 in 1996 to 147 in 2005* Digest of Educations Statistics 2010 (pg.2, pg, 63)

By themselves, these performance data are not inspiring because they show that our middle school and high school students on an average are performing around the 50th percentile. When seen in the international context these results are cause of even more concern. PISA, the OECD's Programme for International Student Assessment, evaluates the quality, equity and efficiency of school systems in some 70 countries that, together, make up nine-tenths of the world economy. PISA tests are designed to find out whether students can use what they have learned in school, and apply their knowledge to real life situations and problems. PISA test results show countries where they stand in relation to other countries and just by themselves, and how effective they educate their children.

In the most recent PISA tests conducted in 2009, American Students came in at #30 in math and #23 in Science. More importantly, less than 10% of American Students scored at the two top levels, Level 5 or Level 6, in math and science. These top performers are capable of applying scientific knowledge and skills to a variety of complex problems drawn from the real world. In contrast, 31%, 50% and 36% of students in Hong Kong-China, Shanghai-China and Singapore scored at Level 5 or Level 6 in math. In addition, 16%, 24% and 20% of students in Hong Kong-China, Shanghai-China and Singapore scored at Level 5 or Level 6 in science. **These**

top performers are capable of applying scientific knowledge and skills to a variety of complex scientific questions drawn from the real world.

At an individual level, because of an increasingly flatter world your competition is not the kid next door any more or from the next state or even from across the country but from across the world. As a society, if we are not able to develop a next generation that is capable of solving the pressing problems we face in many areas, including climate change, social and economic inequality and dwindling natural and energy resources, we will sink into a spiral of decline. It is therefore incumbent on us to figure out how we can address the pressing issue of how to elevate the performance of our students.

Teachers, Parents, and Leaders in Government, Business and Academia are beginning to also realize the importance of students not just mastering their subject matter. In a world that is changing at a fast pace due to globalization and advances in technology, it is increasingly becoming important not just to be proficient in the 3 R's but also in the 4 C's – creativity, critical thinking, communication, and collaboration – known as the 21st century skills.

The challenge therefore in front of us is how to improve our education system in order to prepare our children to effectively deal with the challenges of the 21st century.

I suggest that we can meet this objective by designing a learning environment around networked learning technologies, a project-based learning approach and online and in-person collaborative learning. This will enable our students to develop deep conceptual understanding, strategic thinking capability and the ability to extend their knowledge and thinking to novel situations (transfer). Moreover, such a learning environment will also foster the much needed 21st century skills.

According to Krajcik and Blumenfeld (2006), "project based learning is a form of situated learning and is based on the constructivist finding that students gain a deeper understanding of

material when they actively construct their understanding by working with and using idea". In project-based learning (PBL), students engage in real, meaningful problems that are similar to what they may encounter in their professional lives, and are set in a context that they can relate to. PBL "allows students to investigate questions, propose hypotheses and explanations, discuss their ideas, challenge other ideas and try out new ideas" (Krajcik and Blumenfeld, 2006).

Framing the topic in a real-world setting and one that is familiar to the students, such as their neighborhood, and providing an opportunity to create something will prove engaging to the students as well as root their understanding of the topic in concrete terms. This will enable them to apply the knowledge in various settings.

The combination of individual and collaborative learning in online and classroom settings provides opportunities for students to reflect on their learning and to develop meta-cognition - an understanding of how they learn, how others learn, and how they can learn in different ways.

Learning from peers in online and face-to-face sessions should be an important component of the instructional design. Collaborative discussions, appropriately moderated by the instructor, should be designed to stoke students' imagination and curiosity to develop, analyze, and critique alternative solutions. Each subject unit can incorporate a culminating project that is broadly framed to give students an opportunity to explore and reason different options rather than look for "one right answer".

As can be inferred from the NAEP results and the PISA results, and pointed out by Krajcik and Blumenfeld (2006), schools employing traditional instruction models teach superficial knowledge which prevents students from acquiring a deeper conceptual understanding of material – whether in math, science or literature. When students learn important concepts through structured problems and abstract examples, particularly in a transmit-and-receive mode, they do not understand the deeper meaning in what they are

learning. They also get bored and disconnected from their learning. Instead, if the learning is set in the context of an authentic real-world situation, they are able to gain an appreciation for how the knowledge and the skills they are acquiring can be used to tackle important issues in the real-world, and can become engaged in the learning process.

Members of the project team may bring diverse skills to the table, such as design skills, research and analytical skills, project management skills, leadership skills, presentation skills and conflict resolution skills. The PBL approach will enable these students develop these highly transferable skills which can be applied in future learning and leadership situations.

PBL, because of its focus on situated learning, enables deep understanding of the subject matter. In addition, project based learning approach also helps students to develop transferable skills such as data analysis, design, presentation and other leadership skills that can be very useful in many contexts.

Meta-cognition

The ability to pause to understand one's own learning process and make corrections to leverage strengths and improve in weak areas is a precious gift. In the traditional classroom instruction model, because of the need to keep the pace moving and a predominantly transmit-and-receive instruction, students rarely get an opportunity to reflect on their learning in an objective manner.

The networked technology instructional model, particularly when it is implemented as a 'flipped' classroom, lends itself very well to incorporate meta-cognition moments at appropriate times. Meta-cognition 'stops' can be incorporated as part of the weekly online activities. Reflection prompts such as 'what is working well' and 'how do you plan to use an important knowledge you learned today' help the student think about his or her learning process and to actively manage it. Online collaboration platforms provide the additional benefit

of not only being able to reflect on how you learn but also see how others think they are learning. The instructor is also able to peer into the minds of the students and get a better handle on how he or she should be teaching (rather guiding) them.

Assessment

It can be argued that the current 'summative assessments' we predominantly depend on to evaluate the performance of our students may be at the heart of what is ailing our education system because it does very little to help them learn better. On the contrary, it may discourage the type of learning (and teaching) we need and provide the incentives to learn to and teach to 'testing'.

The proposed networked learning environment and project-based curriculum will enable us to employ 'formative assessments' that will help the teacher use technology to understand the individual strengths and weaknesses of their students and design appropriate learning paths. It will also enable students to demonstrate their learning in different ways as well, not just in a one-size-fits-all kind of multiple choice answers.

Summary

In summary, we need an education system that enables students to understand fundamental concepts in a situated learning environment, learn in an individualized as well as collaborative manner, and have the opportunity to reflect on their learning. This will help us develop a generation of life-long learners who not only have a deep conceptual knowledge but are also able to apply their knowledge to make this world a better place.

References

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About the Author

Kasthuri Gopalaratnam is the Founder & CEO of MatScience21. He has over 25 years of experience in information technology and advanced degrees in Management and Education. He is passionate about educating young children and mentoring professionals to help them realize their true potential. His experience in teaching young children and the gaps he perceived between their education and the skills demanded by modern professions led him to develop MatScience21, a blended after-school enrichment program in math and science for middle school students that will enable them to develop 21st century skills such as creativity, critical thinking, collaboration and communication in addition to acquiring deep conceptual knowledge of the subject matter.