

Editorial

by Gurumurthy Kalyanaram

In this January 2018 issue of the Journal, we present six important and interesting research manuscripts by thoughtful scholars and practitioners.

In this issue, I am presenting below a thought piece on how to balance democratization of education and maintain high-quality. This article was published in the special issue produced on the occasion of the 89th Annual Meet of Association of Indian Universities.

Democratization of High-Quality Education and Effective Learning

Education is a driver of economic development, prosperity, social justice and empowerment. So, as stewards of learning and education we have an obligation and responsibility to enhance these outcomes. This not only requires an understanding of science and technology, commerce and business but also cultivation of values and critical inquiry.

Transformative discoveries in science and technology have come from compelling curiosity. For example, Newton did thought experiments and postulated the laws of motion, the gravitational theory and the differential calculus. Einstein's theory of relativity is more an outcome of his deep reflection, than work in large labs. All these exemplars advise us that our learners should be endowed with imagination and critical thinking. In India, where inclusiveness and innovation are central to our shared prosperity, such attributes are even more urgent.

Research shows that meaningful education and learning increases the lifelong earnings and productivity of individuals (Chetty et. al. 2014, 2011). The demographic shift to a younger population has made quality and democratized education even more important. For example, it is estimated over 60 percent of India's population is less than 30 years old. The estimated median ages for United States, United Kingdom, Russia and China are 36.7, 40.2, 38.4 and 34.1 respectively. But for India the estimated median age is 25.3, a dramatically lower number. The lower median age suggests higher potential work-force productivity for India, but such higher productivity will not materialize without education and skills development (Kalyanaram 2009). Here, our responsibilities and challenges are monumental but so are our potential rewards.

Accordingly, we have to design policies and programs to create high-quality education which is not exclusive or elitist but democratized. Thus, high-quality education should be relatively easily accessible and available. As demonstrated by researchers (Frei, 2006) in other areas, excellence and efficiency or accessibility can be complementary, and they do not have to adversely impact each other.

Such democratization of quality education is unlikely to come from traditional models of education and learning, particularly in India. Take for instance, higher education. For a moment set aside the matter of quality. Numbers don't add up. The number of universities in India is about 600-700. Compare this with over 1,000 universities in US for a population one-fourth of India's population or Japan with about 700 universities for a population almost one-tenth of India's population.

There are many important elements to enriching education and enlarging the reach. In this manuscript, we address three such significant elements: open and distributed-learning, interdisciplinary education and an engaged model of education where learner is an active participant.

Open and Distributed Learning

Both in higher education and in school education, a seismic shift is happening in terms of availability and accessibility of high-quality material on a variety of subject domains. In higher education, the subject materials range from Aerospace to Materials Science to Economics to System Dynamics to Finance. And in school education, the domain of available material ranges from math to physics to chemistry to biology. These advanced material are available on-line, and they are free. There are no fees, no subscriptions.

This shift in higher education began about 2002 when, thanks to Ford Foundation, MIT placed large numbers of advanced course material – complete material including lecture notes, assignments, reading materials – on web portal for anyone in the world to access. This project was called Open Course Ware. Since then over the last decade, there have been wonderful such offerings, including edX and Coursera¹. edX is an outcome of collaboration between MIT and Harvard. The partnership is growing, including the participation by Tsinghua University of China.

The original partners of Coursera were Michigan, Princeton, Stanford and the University of Pennsylvania. And now this partnership has expanded to large numbers of universities including California Institute of Technology; Duke University; the Georgia Institute of Technology; Johns Hopkins University; Rice University; the University of California, San Francisco; the University of Illinois, Urbana-Champaign; the University of Washington; and the University of Virginia, the University of Edinburgh in Scotland, the University of Toronto and EPF Lausanne, a technical university in Switzerland.

These large-scale on-line material has been made possible because of technological advances — among them, the greatly improved quality of online delivery platforms, the ability to personalize material and the capacity to analyze huge numbers of student experiences to see which approach works best. While the initial offerings largely covered computer science, math and engineering, these distributed, on-line offerings are expanding into areas like medicine, poetry and history.

These programs not only offer the learner opportunities to learn at their pace, schedule and time, they also offer opportunities to learn college and university credits and certifications. It's now possible to get a quality college education without the hefty price tag. Recently, courses offered by MIT and Stanford have attracted tens of thousands of learners who participate. For instance, Stanford University's free online artificial intelligence course a few years back attracted 160,000 students from 190 countries. Only a small percentage of the students completed the course, but even so, the numbers were staggering.

¹There are other wonderful such efforts including Udacity, the company founded by Sebastian Thrun of Stanford, who taught the popular artificial intelligence course.

The quality of education is high, and the learning is effective. In fact, learning is as effective as in the traditional mode. For example, research has shown that students who attended a MIT physics class online learned as effectively as students who took the class in person. What's more, the results were the same, regardless of how well the online students scored on a pre-test before taking the class (Colvin et. al. 2014).

Essentially, these offerings are opening higher education to hundreds of millions of people. Now, countries as diverse as France, China, and perhaps most surprisingly, Saudi Arabia, have launched national education platforms powered by edX. In Saudi Arabia, the Ministry of Labor is using Open edX to educate more women, disabled citizens, and people living in rural areas.

In school education, Khan Academy² has become the proto-type of such free, high-quality, distributed material and learning. The material consists of short videos which explain the concepts, and varied exercises to test learning. Shorter videos engage the learners, particularly young learners³. The offering has composed over 4,500 videos on science topics such as biology, chemistry, and physics, and the humanities with tutorials on art, history, civics, finance, and other areas.

In an astounding illustration of this platform, today over 15 million students per month are learning, and they're learning through these video lessons, tutorials and practicing through interactive exercises.

Thanks to technological advances, Khan Academy material is now available on mobile devices. As the Academy states, it is “bringing interactive, personalized learning to the iPad with math exercises, handwriting recognition and more.” According to the report, over 150,000 interactive, common core aligned exercises with instant feedback and step-by-step hints for each question.

What makes Khan Academy even more accessible and powerful is the contribution by Foundation for Learning Equality (FLE). FLE has designed an open source platform, KA Lite, which enables the Khan Academy material to be used even when no Internet is available. Thanks to KA Lite, learners can “connect to the server from within the classroom, on a laptop, tablet, or desktop computer, or it can be installed directly on a learner's computer for portable access.”

Using KA Lite approach, the Motivation for Excellence Foundation in India has brought the interactive material – videos and exercises to almost 50 school class rooms in India – using tablets, and is engaged in a productive project to measure the effectiveness of learning through these material.

Interdisciplinary Education

Interdisciplinary thinking, learning and teaching is fundamental to creative solutions to challenges at hand. And this requires boldness in recruitment of faculty, reshaping of the curriculum and imagination. Empirically, it has been demonstrated that interdisciplinary programs promote cross-fertilization of ideas, creative problem solving,

² There are other education models such as Amplify.

³ It is reported that edX has found, for instance, that the longer a video lecture runs, the less time students spend watching it. So if a video lasts 40 minutes, students may only watch it for 2. If it's 6 minutes long, they'll watch the whole thing.

and greater productivity.

Here are two examples of interdisciplinary approach that Indian business schools and education and should adopt: one at a course-level, and the second at the program-level.

An example of a course, among many other courses, that requires interdisciplinary approach is Product development and design. This course, taught in almost all business schools, has been and continues to be taught by marketing professors. This should not be the case. Product development and design involves understanding the voice of the customer (customer research), designing the robust specifications of the product/service (design engineering), manufacturing the product (manufacturing engineering), and launching the product in the market and developing appropriate strategies (marketing and strategy). So, a course in product development and design should be taught by professors who have substantial training and education in engineering and technology. As early as in early 1990s, MIT Sloan School of Management and Wharton recruited Dr. Steve Eppinger and Dr. Karl Ulrich to teach their product development and design courses, and both of them got their doctoral degrees in mechanical engineering and joined the business schools as young Assistant Professors. They are now highly-cited and well-received business school professors.

Two examples of interdisciplinary programs are Leaders for Global Operations (LGO) Program at MIT, and JD/MBA program at Stanford. As described by MIT, the “Leaders for Global Operations program brings together the rigor and technical expertise of the MIT School of Engineering, the business, leadership practice, and cutting-edge theory of the MIT Sloan School of Management and the real-world experience of the LGO manufacturing and operations industry partners.” The students receive two degrees in two years: an MBA degree and an MS degree in engineering (such as mechanical engineering or electrical engineering). The students in the JD/MBA program at Stanford also get two degrees, one in law and the other an MBA. Stanford describes this joint degree program as, “JD/MBA students experience two complementary intellectual cultures: the problem-spotting, analytical culture of law, and the problem-solving, practical culture of business.”

We need our own indigenous interdisciplinary programs in India. That's our challenge and our opportunity.

Engaged Model of Education and Learning

In this model of active engagement, learners (users) are drivers of value and purpose. Von Hippel (2002), Kalyanaram (2014, 2011) and others have empirically shown that engaged users are the most successful drivers of innovation. Accordingly, learning must be interactive and endogenous (Kalyanaram and Saxena 2012).

That's why many colleges and universities are adopting what is called as a blended learning model. In a blended learning environment, students receive most of their lectures by video so they can spend class time doing hands on work. For instance, at MIT, two out of every three undergrads use edX as part of their on campus courses.

In-class students benefit from the online materials. So, it is productive to let the students do the online lesson first, then come to class for interactive projects and help with problem areas. “The fact that students learn so much from the videos gives me more time to cover the topics I consider more difficult, and to go deeper,” said Dan

Boneh, a Stanford professor who taught Coursera's cryptography course.

It is also demonstrated that hands-on, engaged learning is important to spur innovation. MIT Professor Culpepper says that making things is key to innovation. "You can think about how you might do something, but cogitating will only get you so far. Sometimes it takes building a prototype to have that Eureka moment" where everything falls into place. Access to a prototype can also work in reverse, giving the inventor great ideas for other potential applications. Drawing upon his own experience, Culpepper says, "I built many machines that didn't work. Then I'd figure out what I'd done wrong with the math and physics and try again. Eventually, I succeeded."

Concluding Remarks

To democratize quality education, India must adopt and diffuse new platforms of open and distributed learning which promote inter-disciplinary, engaged and self-learning. Learning material has been designed, technology has evolved, and the approach has now been validated.

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