

The Education and Skills required in the face of disruptive technology to build future startups

Dr. Gurumurthy Kalyanaram
Advisor and Dean, Professor and Management and Policy Consultant

Disruptive ideas, processes and technologies bring disruptive change. And the most important intellectual and mental attributes required to create such technologies and master change brought by these technologies are adaptability and flexibility.

So, what are the skills and educational tools needed to enhance adaptability and flexibility in individuals and organizations, and to improve the odds of both creating and mastering disruptive change? Ability to re-learn and re-invent; think eclectically and systematically; and build imaginative mental models.

Re-learning and Re-invention

As has been demonstrated, individuals and organizations who learn, unlearn and re-learn (‘learning individuals and organizations’ Peter Senge (1990)) are most adept in ‘generative’ learning that enhances our capacity to create and adopt new and disruptive knowledge and technologies. Take, for example, the automotive industry: internal combustion engine cars required certain manufacturing principles, technologies and equipment, but manufacture of hybrid or electric cars requires disruptively different technologies. Will Ford or Honda be a successful electric car manufacturer? May be. It requires Honda as an organization and its employees as individuals to unlearn (forget) the current technology and then learn the new disruptive technology. Some individuals and organizations do it and others do not. Polaroid did not unlearn and re-learn when the technology moved from analog to digital but Canon did.

Eclectic and Systemic Thinking

Human beings and organizations are motivated to find a cause and effect relationship to their actions. This urge quite often leads to linear and modular thinking. When telecommunication technologies became prevalent, we predicted that travel will decrease. That did not happen. When sound and image recording technologies became accessible, we predicted that number of audience for concerts and movies will decrease. That did not happen. And so on. We were wrong ó as we quite are often with disruptive technologies ó

because we apply linear and silo thinking. For instance, disruptive technologies in nano-material impacts many of our activities simultaneously: robustness of our heart-stents and knee-replacements, durability of our homes and buildings, and strength and safety of our cars, trains and airplanes. Or, for instance, take genetically modified food technology: it will affect our agricultural economy, food processing, health, consumption patterns, retail industry and commerce, and more. Accordingly, imposition of linear and modular thinking on the impact of these disruptive technologies will lead to incorrect conclusions. So, what is needed is an eclectic and systemic thinking.

Mental Models, and Imagining

How do we enhance our ability to undo and redo, unlearn and re-learn, think systematically and eclectically? Sure, practice and experience help. But disruptive changes and technologies do not happen every day. May be they happen every five or ten or twenty years. So, experiential learning is limited. That's where imagination and mental models are incredibly powerful. Great athletes, artists, leaders are successful because they imagine and build mental models which are imagined representations of real, hypothetical, or imaginary situations. For instance, Steve Jobs created disruptive i-series (e.g., iPod, iTunes, iPad, and iPhone) technologies through imagination and eclectic thinking. And 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. So, imagination and rich mental models are most powerful vehicles to generate and master disruptive ideas and technologies.

Engaged Education and Learning, and Democratization of Learning

So, how do we go about building these skills in our citizens and organizations? Engaged education and learning are the obvious instruments. In one form of engaged learning (also called, a blended learning) environment, students receive most of their lectures by videos so they can spend class time doing hands on work. For instance, at MIT, two out of every three undergrads uses edX (on-line platform) 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. Self-guided learning has demonstrated ability to develop and nurture greater inherent

capacity to unlearn and re-learn, and to reflect and wonder and think eclectically.

Accordingly, we have to design policies and programs to create engaged education.

But what is also important for large-scale adoption of disruptive technologies is democratization (i.e., make available to everyone) of such education. In all levels of education, a seismic shift is happening in terms of availability and accessibility. This shift in higher education began about 2002 when, thanks to Ford Foundation, MIT placed large numbers of advanced course material ó complete material including lecture notes, assignments, reading materials ó 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 many enriched and engages offerings, including edX, Coursera and Udacity. In school education, Khan Academy and Amplify and others have become the proto-type of such self-guided learning and high-quality, distributed material.

Eclecticism and interdisciplinary thinking are an outcome of these engaged learning approaches. They lead to cross-fertilization of ideas, creative problem solving, and greater productivity.

As an illustration, here are some examples of interdisciplinary approach just from one university -- MIT. Every student in the first year at MIT has to do a course in Life Science, even if the student was majoring in linguistics, because life science is fundamental and integrative. Two, MIT created Media Lab with exclusive purpose of promoting òa unique, anti-disciplinary cultureö beyond known boundaries and disciplines, and to encourage òthe most unconventional mixing and matching of seemingly disparate research areas.ö The MIT Media Lab creates òdisruptive technologiesö that happen at the edges, pioneering such areas as wearable computing, tangible interfaces, and affective computing. Three, MIT has created a university-level office to create ònew opportunities at the intersections of MIT's five schools: Architecture and Planning; Engineering; Humanities, Arts, and Social Sciences; Management; and Science.ö

In School education, as an illustration, the well-celebrated AltSchool accomplishes this by offering òpersonalized educationö for an òever-changing worldö through facilitating students drive their own learning, and connecting them with experts and institutions in the community to enrich the learning experience and keep them wanting more. All this happens

because the teachers are also engaged by building learning experiences that are adaptive at their core and keep the children engaged.

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

Engaged Teachers, Who can also Re-learn and Reinvent

But what is missing globally, and most poignantly relevant for India -- is a platform for the teachers to learn, unlearn, re-learn on a large scale in a self-guided and reflective manner. We need to design platform(s) with an ability to personalize material and the capacity to analyze huge numbers of teacher experiences to see which approach works best. The offerings should cover the entire domain of teaching and learning including math and engineering, science, medicine, poetry and history so that teachers may learn at their pace, schedule and time and reflect and integrate.

Without engaged teachers, there can be no engaged learning. That's why lots of platforms including Coursera and may be even Khan Academy do while they get large number of unique users do not possibly produce generative learning. But edX by MIT enhances generative learning of students because the platform has been created by the teachers who are using it for their own generative learning.

While India will be able to adapt some of the ubiquitous platforms for learners, the policy leaders have to focus on development of similar platforms for teachers. Particularly in India, where by tradition and circumstance the teacher has a larger imprint, this need is urgent. Among the very large disenfranchised and impoverished segment of Indian learners, teacher is critical link to upgrading education and skills.

Why and What?

The demographic shift to a younger population in India has made engaged and democratized education urgent. The lower median age suggests higher potential work-force productivity for India, but such higher productivity will not materialize without education and skills development to create and master disruptive ideas and technologies. Here, our responsibilities and challenges are monumental but so are our potential rewards.

So, what do we do? Design platforms for learners and teachers at all levels (school, college and university) to self-learn, pause, reflect, integrate, and then unlearn and re-learn

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12.8.2015

when necessary. While there are increasing number plausible platforms available for learners, there is no such credible platform for teachers. We need to design an indigenous platform for teachers in India. While all levels of education are important, school education is most critical. Research shows better engaged school education produces dramatic increases in the lifelong earnings and productivity of individuals (Chetty et. al. 2014, 2011).

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12.8.2015

Dr. Gurumurthy Kalyanaram Bio

Dr. Gurumurthy Kalyanaram (www.gkalyan.com) is an academic who has served as Dean and Professor globally including in The University of Texas, International University of Japan, and Tata Institute of Social Sciences. Dr. Kalyanaram is a highly-cited scholar, whose research covers management science, education and public policy, economics and innovation. He serves as a management and policy consultant to many organizations. Dr. Kalyanaram got his doctoral degree from Massachusetts Institute of Technology, and he has been recognized by MIT with Harold Lobdell Award. Currently, he serves as the President of global MIT South Asian Alumni Association.