

## New liberal arts and science institutions in India and Singapore – the role of STEM education

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### Abstract

An overview of higher education within India reveals a profound set of challenges, and vast unmet demand for both a greater quantity and quality of higher education. The rise of India's middle class, demographics that give India the largest under-20 cohort in the world, and emerging high-tech sectors, make the development of new models of higher education in India an urgent priority. Fortunately, private philanthropy has enabled the development of a new sector of Indian higher education - the privately funded liberal arts and science university - that offers high quality undergraduate liberal arts in an Indian context. I will review the founding and curriculum of some of the new institutions in India, and how they each provide different answers for what liberal arts and STEM education means in India. The Yale-NUS College in Singapore provides an interesting counterpoint, and I review its curriculum and how it provides a unique embodiment of what Rabindranath Tagore labeled the "Eastern University." Together these institutions within India and Singapore offer great promise to respond creatively to the challenges facing India and Asia, and to educate students with a new set of skills that are both rooted in the 21st century and in the cultures of India and Singapore.

## 21st Century Skills and Indian Higher Education

Within our Dialog on Liberal Arts we have discussed many concepts that define the educated person, often expressed as a list of virtues. Our list of virtues may arise from Chinese Confucian or Taoist traditions, or can be reverse-engineered from successful alumni or entrepreneurs where they often are described as “21st century skills.” These virtues of an educated person form the ultimate learning outcomes which we should develop carefully in discussion with a wide variety of stakeholders - CEOs, employers, faculty, parents, and funding agencies. These virtues are intended to enable graduates to lead a successful life as it might be defined within the social, cultural and political environment in which the graduates will live. Our Dialog on Liberal Arts in the 21st century necessarily should include a thorough discussion on the new concepts of higher education being developed in India, home to 1.2 billion people and the site of a burgeoning new sector of higher education - the Indian private liberal arts and sciences university.

The 20th century writer F. Scott Fitzgerald said that “the test of a first-rate intelligence is the ability to hold two opposed ideas in mind at the same time and still retain the ability to function” (Fitzgerald, 1922). Keats in his piece “On Overcoming Milton” described a form of creativity exemplified by Shakespeare as “negative capability.” Negative capability includes a form of intuition that transcends the rational analytic mind by developing *empathy* for its subject, and which tolerates uncertainties “without any irritable reaching after fact and reason” (Pollard, 2015). The complexities of life in our 21st century demand these virtues more than ever, and

such virtues are especially important for higher education within India with its thriving multi-layered, diverse and complex culture. Rabindranath Tagore argues in his piece on *The Religion of Man* (1930) that progress can only happen through a form of education that cultivates “inclusive sympathy” through “global learning, the arts and Socratic self-criticism” - all elements within modern liberal arts, and all which enable students to understand complexity and diversity (Nussbaum, 2011).

India is a place of simultaneous opposites. While India offers some of the most advanced multi-billion dollar high-tech companies in the world such as WIPRO, Infosys, Accenture, they co-exist adjacent to traditional and rural communities that continue practices from thousands of years ago. India is a country with pockets of unmatched wealth in its cities next door to some of the most desperately poor settlements in the world. Within its road system India offers fascinating laboratories of collective behavior that could challenge systems analysts or chaos theorists for decades to come! On the other side of walls that line India's roads are some of the most advanced corporate training compounds, science laboratories and hospitals, as well as some of the most serene and beautiful temples, gardens, and homes in the world.

India also has a proud academic tradition that includes some of the first universities in the world, such as the ancient Nalanda University, which housed a vast library and was filled with large numbers of international scholars in Buddhism, medicine and other subjects from 400 to 1200 CE. India developed some of the first notions of what we might call liberal arts in Vedic times, and is home perhaps the first Asian liberal arts college, Shantiniketan, founded by Rabindranath Tagore in 1901. Liberal Arts and Sciences in India, much like in the rest of Asia, is of particular interest today, as India faces a wave of growth in its economy (currently growing at 8%

annually) and very young population (currently growing at 4.5% annually). India's rapid economic and demographic growth has sparked many urgent environmental issues, as well as a massive unmet need for higher education to develop a well-trained workforce with what we have been calling "21st century skills" (BRC 2014).

A few numbers can help further sharpen the dilemmas faced by India's higher education system, which has interesting comparisons with China. India, like China, has a very large population. India's population currently stands at 1.22 billion (compared to China's 1.37 billion), and is growing rapidly to overtake China in the coming decade. India already has the largest population of under 20 individuals in the world, approaching 300 million by the year 2030 (FICCI 2013). India, like China, has a rapidly expanding middle class, which by some estimates exceeds 300 million as well. Like China, India has an extremely strong cultural emphasis on exam-based proficiency and academic success, with "toppers" (those who make the best national exam scores) making headlines within newspapers and becoming minor celebrities within their home towns. India's higher education system, like many other things within India, has attempted to expand very rapidly and strains to meet the demands of the new middle class, as it aspires to educate their children. Like China, India has about 17-20% of its young people enrolled in tertiary education, and has a need to rapidly expand its higher education system - perhaps by factors of 5 or more - to fully meet this demand (ACE/CIHE, 2013).

Unlike China, India lacks efficient and centralized strategic planning. India faces massive shortages of teachers and professors, with shortages of secondary and tertiary professors exceeding one hundred thousand, and large drop-out rates that approach 30% by grade 8 (BRC, 2014). Together, these factors prevent delivery of higher education or even a high school

education to a vast majority of India's large population. Amartya Sen, describes in his book *The Argumentative Indian* some of the complexities of achieving consensus within India, in which "heterodoxy is a natural state of affairs" and how argument and prolixity are intrinsic aspects of India's public life for over a thousand years (Sen, 2005). This means that with 1.3 billion Indians there are nearly as many opinions within India about how to reform and expand its education system! All however would agree on the need for resources - which are vastly less than needed for developing rural schools, for training teachers, and for creating the types of excellent holistic education and active learning we have discussed within this room, on a wider basis.

The recent election of Narendra Modi, widely applauded in the US Indian NRI community, has yet to yield dividends for India's higher education system. Modi has been labelled as a reformer who can energize and spark the kinds of needed changes within India's education system. Modi's government has discussed abolishing the widely criticized Higher Education Planning Commission known as the University Grants Commission or UGC, which regulates higher education. But as yet there has been little progress in the promised increases in autonomy and resources to universities (Kohli, 2015). Within the two different bodies that govern Indian higher education, the UGC and the National Knowledge commission, there can often be two or more opinions and sometimes contradictory recommendations, that often interfere with much-needed reforms or with the founding of new institutions (Tharoor, 2015). The much needed expansion of India's university system which could include 5 new IIT campuses has yet to be implemented, and also seems to be underfunded by the government. According to one source, education funding had increased by 18 and 8 percent in the past two years, but in the current budget faces a lower percentage of growth than India's GDP expansion (Narayanan, 2015).

India is well known for its excellent IIT graduates, who in many cases (like MIT graduates) form companies that have fueled much of India's economic growth. IIT graduates emerge from a nearly life-long selection process and represent the top 0.1 percentile of India's student population, with less than 2% of IIT applicants being selected. The intense selectivity is partly due to the low capacity of the IIT system, which in its 16 campuses are able to educate about 10,000 undergraduate students each year, after receiving applications from about 500,000 students.

To attempt to meet the demands for increased capacity of higher education in India, India has built the largest number of educational institutions in the world. These institutions all face a very complex regulatory environment governed by the UGC and span a vast range in quality. In 1956 when the UGC was created there were about 30 universities within India. This number grew to 200 in 1990, and is now at approximately 666, with over 14,000 Colleges within India (BRC, 2014). The expansion in number of institutions has included the development of a large number of for-profit private institutions that are of very low quality, and even the best of India's universities lag behind in international rankings. An oft-cited statistic within India is that none of the top 200 world ranked universities are Indian, and among the top 300 only two Indian institutions are included - one IIT campus and the University of Delhi (Hindustani Times, 2013).

One new solution to creating high-quality higher education in India is the private, liberal arts and sciences university, founded by partnerships between philanthropists and high-tech entrepreneurs. Indian technology leaders often bring hybrid international perspectives to their approach toward higher education, as many received graduate degrees abroad after growing up within the Indian secondary education system, and in some cases the IIT undergraduate

system. New institutions are being founded to address some of the unmet needs of the Indian companies, who are demanding agile and innovative employees. These institutions also promise to help meet the challenges of Indian society, which requires graduates with broad and deep knowledge of India's cultural history, politics, and arts as well as deep proficiency and facility with STEM subjects. Since most of these new institutions are being funded by private money, they are able to implement new forms of curriculum and faculty governance without government regulation and interference. At least eight of these new universities have been founded since 2011, and they provide a diverse and exciting range of new models for liberal arts and sciences in India.

To help foster a dialog among these emerging institutions within India, and to facilitate collaborations internationally with North America and Asia, I co-organized two conferences within India on the "Future of Liberal Arts and Sciences in India." The first of the meetings was in Bangalore during January 2014, and was hosted by the Raman Research Institute (RRI) and Indian Institute of Human Settlements (IIHS). Our meeting featured the founding Vice Chancellors and Presidents of 8 new Asian liberal arts institutions, as well as Presidents and Chancellors from two UC campuses and some of the best liberal arts colleges in the US. Our meeting also featured leaders within India from government, large corporations, NGOs, and even new private high schools within India (Penprase, 2015a). The first meeting discussed the array of issues facing higher education in India, and also set the stage for a second meeting in March 2015 in New Delhi. Our second meeting convened on the new campuses of two new Indian liberal arts institutions described below - Ashoka University and the O.P. Jindal Global University. We also convened for a day at the new U. of Chicago center in New Delhi. We are working on gathering the materials from both conferences to a website for an online conference

proceedings that should be a valuable resource for understanding Indian liberal arts and sciences within India (Penprase, 2015b). Below is a brief overview of some of the properties of a cross-section of these remarkable new higher education institutions within India, with short synopses to give a sense of the institutions, their founders, and their different approaches to higher education and liberal arts in the Indian context.

Ashoka University was founded by a group of US-educated entrepreneurs, such as the Yale alumnus and philanthropist Ashish Dawan, who also created the Central Square Foundation dedicated to providing education to children within slums in India. Ashoka University aspires to be the “Yale of India.” Among the founders of Ashoka University is Pramath Sinha, founding Vice Chancellor of Ashoka. Pramath was educated at an IIT, and previously founded the Indian School of Business, as well as a business partnership with Madeline Albright. The Ashoka University founders began by establishing the “Young India Fellowship,” a one-year multidisciplinary postgraduate program in Liberal Studies and Leadership (Ashoka University, 2015). The Young India Fellowship includes a year of study with lectures from a wide variety of disciplines in humanities, sciences in arts. Fellows complete a project at the end of the year that blends liberal arts with an internship and mentoring from the instructors in the program. The program has grown in its three years to 200 fellows from its initial batch of 58 students, and is now housed at the new Ashoka University campus. The Ashoka University opened in 2014-15 with its first class of 65 boys and 68 girls, and they are admitting their second batch this year in 2015 (YIF, 2015). The Ashoka curriculum includes 12 Foundation Courses, which offers a diverse mix of sciences and humanities. Students then choose a major, which consists of 12-16 courses in about 12 different fields. Ashoka University has developed its curriculum with academic partnerships with Carleton College, Sciences Po (France), Penn Engineering, the



University of Michigan, and King's College (UK). The Ashoka STEM curriculum includes Principles of Science (focusing on ways of knowing and scientific inquiry), Mind and Behaviour, and Introduction to Mathematical Thinking. The plan is for Ashoka to grow beyond 2000 students in the coming years, with both undergraduate and graduate programs.

The O. P. Jindal Global University was founded in 2011, and has five graduate programs, with a newly created undergraduate program in Liberal Studies and Humanities described by Kathleen Madrowski earlier in our conference. Raj Kumar, its founding Vice Chancellor, returned to India after an academic odyssey that included a Rhodes scholarship at Oxford, a L.L.M. degree from Harvard Law, and teaching jobs at the University of Hong Kong and the University of New Delhi. Raj's experiences with international higher education inspired him to establish an institution in India with a similar focus on excellence. Steel magnate Naveen Jindal contributed funds for the expansive campus, and named the institution after his father, O.P. Jindal. The school is best known for its excellent law school with strong programs in international justice and human rights, and also has robust graduate programs in business, international affairs, as well as government and public policy. A dual degree program has been developed with Rollins College in Florida. Jindal undergraduates will complete two years at Jindal, and then receive a dual degree from Rollins - enabling Indian students to receive a liberal arts and sciences education in both countries. Other academic partners for Jindal include Indiana University Bloomington, University of Arizona, University of California Berkeley, Tilburg University (for joint law degrees), and the University of Texas at Dallas for a joint Business degree.

Shiv Nadar University (SNU) was founded in 2011 with the help of the eponymous Shiv Nadar, who made his fortune after founding the tech company HCL. The Founding Vice Chancellor,

Nikhil Sinha, rapidly assembled a complete university with graduate and undergraduate programs on a 286 acre campus in just four years. Shiv Nadar University is one of the older and larger of these new Indian institutions, with a total of 1250 undergrads, and 250 graduates. The institution conducts significant science and engineering research, and offers PhD programs in several of the natural sciences. The schools of SNU include Engineering, Humanities and Social Sciences, Law, Management and Entrepreneurship, and Natural Sciences. Academic partners include Duke University, University of Pennsylvania, and Babson College. One of the very nice partnerships at SNU is a 2+2 partnership with Carnegie Mellon University. In this program, students will take their first and third years at SNU, and then their second and fourth years at CMU. At the end, students would then be awarded a two degrees (one each from both Shiv Nadar University and Carnegie Mellon University) with full ABET accreditation. One other interesting innovation for SNU is that it offers merit based, need blind admissions, using high school grades but also a special aptitude test, like the SAT but custom-made for SNU by Pearson Education. The admissions office also includes essays and interviews of all of the candidates as part of the process. The faculty are involved in this interviewing process, making them fully part of admissions, instead of having it outsourced to a separate department. SNU has already become a selective institution in its short history - with thousands of students applying for admission, and less than 25% being selected. It will graduate its first batch of undergraduate students in 2015.

IIT Gandhinagar (IIT Gh) is one of the newest of the famed IIT campuses, founded in 2008 in Ahmedabad in Gujarat province. While not a true liberal arts institution, IIT Gh has some novel features for an Indian university, as it blends humanities and arts into the studies of all of its young engineers. IIT Gh offers 4-year BTech and MTech programs in five branches of engineering as well as 2-year MSc programs in several science areas. Ph.D. programs are

offered in seven areas of engineering, as well as in the four physical sciences. IIT Gh also has a 2-year MA program in Society and Culture, and offers Ph. D. degrees in History, Literature, Philosophy, Psychology, Sociology, and Social Epidemiology. The founding director, Sudhir Jain, has intentionally brought a mix of liberal arts, critical thinking and humanities into his IIT campus. One of the most innovative features within IIT Gh is a 5-week Foundation Program which is offered to a mix of overseas students from Caltech and the entering class of Indian IIT students. The program is known as *India Ki Khoj* or "*Discovery of India*" and has "been designed to help overseas students relate with this idea and the many layers that form identity in India." The program works with a combination of academic topics and field trips, to "communicate the many imaginations about India" and to "take students through the India of the past, present and future" and to connect India's ancient traditions of philosophy to its present (IIT Gh, 2015).

Azim Premji University is another example of private philanthropy creating a new form of higher education in India. The Azim Premji University is the most recent project for the multi-billion dollar Azim Premji Foundation, which is dedicated to creating a "just, equitable, humane and sustainable society" within India by "making deep, large scale and institutionalized impact on the quality and equity of education in India, along with related development areas" (APF, 2015). Azim Premji, the namesake of both the University and the Foundation, was educated with a B.S. in Electrical Engineering from Stanford University, and began his business career in 1967 at the young age of 22, when he took over the Wipro Limited corporation. Wipro is now a multibillion dollar technology company with 2013 revenues of \$6.9 billion and over 145,000 employees serving clients in 57 countries. Azim Premji is one of the world's wealthiest men, listed as 41st richest in the world, with a personal fortune of \$17.2 billion. He founded Azim Premji foundation

in 2001, with the goal to contribute to high quality and universal education in India. The foundation funds pilot programs in public schools in India, and pledged to contribute \$2 billion to have a major impact on the 1.4 million schools within India. Azim Premji also has joined Bill Gates "Giving Pledge" program to give most of his wealth to charitable causes along with Warren Buffet and Richard Branson (Wipro, 2015). Azim Premji University programs are designed to create talent, knowledge, and also social change, and are focused in several interdisciplinary programs. Azim Premji University offers Master of Arts in Education or Development, conducts research in education and development, and houses a continuing education center for teachers. The Azim Premji curriculum includes interdisciplinary explorations of socially relevant themes. Examples include courses in "Law, Governance and Development," "Mind and Society," "People and Ideas," and "The Philosophy of Education." The undergraduate program at Azim Premji is similarly interdisciplinary, and will open with its first batch of students in 2015. It will offer major concentrations to undergraduates in four areas - Physics, Biology, Economics and Combined Humanities - and in each of majors, the curriculum emphasizes the connections between these disciplines and India's culture and society (APU, 2015).

The Indian Institute of Human Settlements (IIHS) in Bangalore aims to both study India's rapid growth and shape this growth by training experts in "Urban Practice" through a master's degree program. IIHS hopes to "address challenges of urbanization through an integrated program of education, research, consulting and advisory services." IIHS also plans to expand into a full-fledged university, perhaps with multiple campuses, to provide both undergraduate programs and PhD degrees. The IIHS University would have schools of environment and sustainability, human development, economic development, governance and policy, and settlements and infrastructure. IIHS has been funded by grants from Bangalore's high-tech entrepreneurial

community, with multi-million dollar grants from Nandan Nilekani, former CEO of Infosys. The founding director of IIHS, Aromar Revi, describes how the IIHS can help understand India's complexity, especially in its rapidly expanding cities. According to Aromar, "the most complex systems that have been built by human beings are cities. We have lived and worked in them for 5000 years, but we don't know how to manage them at the scale necessary in a largely urban world." The IIHS strategy is on two levels - to train practitioners from companies, government, and civil society organizations through short courses, and to develop a "cloud of practitioners" who can help guide projects that both educate students and help solve local problems via their practice. IIHS also hopes to train graduates who are able to answer not only technical questions (the "what, how and when") but find the deeper causes of problems by asking "why" systems are in their current state. The IIHS provides a laboratory for studying and helping solve India's problems, which can then be used to help other countries such as Brazil, Mexico and China which have similar issues of sustainability and urbanization. According to Aromar Revi, "India has a monopoly on some of the most complex problems that the world may face in the 21st century" and the IIHS is working to develop the necessary theory, perspectives, and practices to help address these problems in a way that can possibly be adopted for other countries in the coming decades (Revi, 2013).

The final institution I would like to mention is Yale-NUS College in Singapore - which while not in India, provides another example of new models for higher education within South and Southeast Asia. Yale-NUS College has also been actively involved in both of the "Future of Liberal Arts in India" conferences, and is beginning to collaborate with many of these newly developed Indian institutions. The curriculum at Yale-NUS College was design to answer the question of "what

must a young person learn in order to lead a responsible life in this century?" The curriculum was designed after a careful study of the history of higher education, such as the Yale curriculum report of 1828, with its metaphor of building the "discipline and furniture of the mind." Within Yale-NUS College is a broad and deep common curriculum that blends Eastern and Western works and that integrates science and quantitative work in the study of all the students. Within the courses is "a focus on articulate communication," "open, informed and reflective discourse" (Garsten et al, 2013). Students at Yale-NUS College take nearly two years of a common curriculum to provide a common base of understanding and discussion, and these courses include a full two years of STEM subjects, beginning with Scientific Inquiry, which explores the ways in which science and math conceptualizes and discovers aspects of nature, Quantitative Reasoning, which combines social sciences, programming, and statistics, and a two semester course entitled Foundations of Science, which examines a range of science topics from disciplinary perspectives and then combines students into common experiences that include field work in Malaysia, and developing answer to "Grand Challenge" questions such as global warming and disaster response (Penprase, 2015c). The Yale-NUS College science curriculum is designed to provide the form of interdisciplinary education that will enable students to help solve some of the complex problems facing Asia and the world in 2015, and that will enable them to be responsive and informed citizens and policy makers.

From the above discussion we can see how the diverse range of new institutions being developed within India and Singapore are redefining liberal arts and science education in South and Southeast Asia. These new institutions are really not adopting an American model but reinventing a form of education that has been in practice in Asia for centuries - in India, in China and elsewhere. As such these new institutions in Singapore and India are building on their

campuses a form of education that Tagore envisioned in his essay entitled “An Eastern University” (Tagore, 1922):

*“For our universities we must claim, not labeled packages of truth and authorized agents to distribute them, but truth in its living association with her lovers and seekers and discoverers. Also we must know that the concentration of the mind-forces scattered throughout the country is the most important mission of a University, which, like the nucleus of a living cell, should be the center of the intellectual life of the people.”*

*Rabindranath Tagore, “An Eastern University”*

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