

There is a need to relook at our current education scenario from a scientific perspective by analysing the causes of its deterioration and the possible remedies.

THE National Science Day is an opportune time to revisit our educational system. Past studies and reports by thinkers and planners have observed that the country's existing education structures have not been able to imbibe a proper scientific culture and have been falling short of the expectations of the country. They have also expressed a need for the overhaul of the current education system to meet the challenges before India aspiring to become a knowledge society.

Education broadly refers to facilitating the acquisition of knowledge, skills and wisdom. This process gets structured in case of formal education. Though it is often argued that such structuring is necessary in facilitating learning, quite often it is found that the structures become prone to rigidity obscuring the primary goals of education. We can understand this with the example of the current scenario of engineering education, considered to be one of the most sought after education domains.

TABLE 1. NUMBER AND INTAKE OF ENGINEERING INSTITUTES IN INDIA
(www.aicte-india.org)

	At the time of independence	In 2015-16
Number of engineering institutes in India	44	3345
Total intake capacity of students	3200	1630790

Table 1 compares the present number and intake of engineering institutes in India with that at the time of independence. The comparison shows that we have more number of engineering institutes in the country than the number of engineering students at the time of independence. The number of institutes has multiplied about 76 times and the intake capacity, about 510 times.

However, recent reports of growing unemployability of engineering graduates and the rapidly declining interest of the youth in engineering education clearly indicate that this steep quantitative growth has failed to maintain consonance with the basic goals of education. According to recent statistics, over 80% of the engineering graduates in the country are

unemployable [*National Employability Report (2015-16)* by Aspiring Minds] and about 50% engineering seats across the country have been remaining vacant since the last few years (www.aicte-india.org).

When these structures were first introduced, they served their intended purpose resulting in a satisfactory balance between students admitted, students graduated and students employed. As the number started increasing, several factors started contributing to reducing the meaning of education just to prepare students for knowing the answers to given questions based on the given syllabi and to reproduce them in examinations of given formats. Thus, knowledge started getting imprisoned in the rigid confines of marks and degrees.



OBSERVATIONS ON CURRENT EDUCATION SCENARIO IN INDIA

“... too many of our higher educational institutions are simply not up to the mark... still producing graduates in subjects that the job market no longer requires.”

Excerpt from the Prime Minister's speech at a conference of vice-chancellors of central universities at Rashtrapati Bhawan in February 2013.

Higher education in India: Vision 2030, www.ey.com/.../EYHigher-education-in-India-Vision-2030.pdf

“There is need for Indian universities to catch up with counterparts in the quality of teaching and research. Research and innovation must be given new impetus. ...The total number of patent applications filed by Indians in 2010 was close to only six thousand, while 3 lakh applications were filed by Chinese, around 1.7 lakh filed by Germans, 4.5 lakh by Japanese, and 4.2 lakh by Americans. The number of patent applications by Indians comprised only 0.3 per cent of the total applications filed in the world.”

Excerpt from the speech by the President, Shri Pranab Mukherjee, delivered at the convocation of SIDO KANHU MURMU.

“... We have emphasized delivery of information and rewarded capability of storing information. This does not help in creating a knowledge society.”

“... A university is a place where new ideas germinate, strike roots and grow tall and sturdy. It is a unique space, which covers the entire universe of knowledge. ... Established notions of truth are challenged in the pursuit of knowledge. This universal approach to knowledge demands that boundaries of disciplines be porous and scholars be constantly on guard against the tendency towards 'cubicalization' of knowledge.”

Developmental goals demand strengthening the links of education with research, industry and culture, whereas our present structures, barring few exceptions (like IITs and BITS Pilani, which represent just about 1% of the total engineering graduates turned out every year), have rather obscured these links leading to education becoming a goal in itself, bereft of challenges pertaining to the creation and application of knowledge. This has shrunk the vast field of curiosity and creativity, of questioning and exploring, and of inventions and discoveries to a narrow field of examinations, marks and degrees.

With marks and degrees taking precedence over knowledge and understanding, several compromises on the academic front started creeping in leading to the distortion and deterioration of learning processes. It is a widely shared experience that industries often overlook the marks earned by students finding them unrelated to their knowledge and skill-based competencies. This gradual loss of faith of the industry in the products

of engineering education has led to a decline in the interest of society and stakeholders in this education resulting in lakhs of engineering seats remaining

vacant. Moreover, it is also common to find many of the engineering graduates doing jobs that have no links with what they studied.

BEYOND MARKS AND DEGREES

KNOWLEDGE, SKILLS AND WISDOM

Unbelievable/Amazing Powers of Knowledge

Discovering the joy of knowledge- Eureka Moments of scientists

Learning through jokes

Curiosity Corner- Knowledge around you

Learning through Pictures/ Sketches/ Diagrams

Learning through failures- Struggle stories to success stories

Learning by doing

Knowledge for career edge- learning through applications


Seamless and Holistic Knowledge

Wonderful and Exciting Knowledge

Learning through quotations- Pearls in the ocean of Knowledge and wisdom

Advancing Frontiers of Knowledge

Know and Grow with Knowledge Center, PIET



“... it would be necessary that the universities adopt a curricular approach which treats knowledge in a holistic manner and creates exciting opportunities for different kinds of interfaces between the disciplines, which is unthinkable today in most of the universities and institutions of higher learning.”

Report of the Committee to Advise on Renovation and Rejuvenation of Higher Education, mhrd.gov.in/sites/upload_files/mhrd/files/...reports/YPC.Report.pdf

“... The enormous potential for India to become a leading knowledge power in the coming years can be realized only if our younger generation has opportunities for all-round good education and training, especially in science and technology. Unfortunately, however, the present state of higher education in the country is rather poor. In order to make it more relevant to the changing needs of society and thus to propel India to a position of leading knowledge power, we need massive investments as well as well-planned radical changes in our higher education system.”

'Restructuring post school science teaching programmes', position paper by Joint Science Education Panel, Resonance, December 2008.

“The entire process of teaching-learning (education) is very structured. ... The challenges thrown to pupils are also either 'known' or 'similar' to known. ... Let the thick walls of examination 'pattern', assessment 'schemes', 'framed' course curriculum and all such rigid structures be demolished. ... Instead let the student be taught fundamentals of the course and made to 'explore' the course of his own. Let the entire education process be made as unstructured as possible and lifelike.”

S. A. Mandavgane, "Shift from structured to unstructured education system", 3rd International Conference on Creativity and Innovations at Grassroots, January 19-22, 2015, IIM, Ahmedabad

Marks & Degrees to Knowledge, Skills & Wisdom

As we dawn upon the reality that education plays an indirect and intermediate role, whereas knowledge, skills and wisdom play a direct and ultimate role in progress, all our marks and degrees lose meaning in a broader developmental perspective if they can't flourish our research, industry and culture. Though several compensatory measures have come up from governmental and non-governmental initiatives from time to time to fill the lacunae left by our education structures, there has been a dearth of grass root initiatives that could provide comprehensive solutions to the existing problems.

Knowledge, skills and wisdom are too open and too common to be noticed but too strong to be ignored. They arise in context of their needs and uses and attract due to their charms and challenges.

At our institute we have taken initiatives to move from the limited world of marks and degrees to the unlimited world of knowledge, skills and wisdom. We organised several discussions and activities involving students and experts, which opened doors to many new ways of learning that our present system almost prohibits or leaves unaddressed.

We followed a cafeteria approach by facilitating students to uncover and discover what they cover as a part of

their syllabi. The activities undertaken as a part of our initiative can be broadly summarised into (i) learning through curiosity and exploration and (ii) learning by doing to achieve the fourfold objective of enjoyment, employment, empowerment and enlightenment of learners.

Learning through Curiosity & Exploration

Students were encouraged to ask questions that aroused their natural curiosity and were guided by the faculty in their attempt towards quenching it through exploration. An attempt was made to attract students towards learning through this mode by displaying, in the knowledge corridor developed for this purpose, posters of several interesting stories and anecdotes about what triggered the curiosities of scientists, how they quenched their curiosities through painstaking and assiduous struggles and how they reached their eureka moments. Students were also guided in their research pursuits at even the undergraduate level.

Table 2. Learning motivations of students

How lasers can be used to correct eye defects?
How synthetic diamonds can be produced?
What is the origin of colours of butterfly wings?
What is the basic structure of electron?
How we can define time? Does time depend on motion or motion depends on time or both are interdependent?
In the Apollo experiment how the distance between the earth and moon was determined with a great accuracy using a laser beam?
How can we build our own laser?
How huge stone blocks were placed to construct the pyramids?
How interference helps to measure the diameter of stars?
How laser is used to read a CD?
Why does laser phenomenon not occur naturally?

This activity brought to the fore many subtleties of knowledge that cannot be handled well in a structured pattern. It shifted the current emphasis of reading the lines and reproducing them in examinations to reading between the lines and developing insights. The activity revealed a vast spectrum of the learning motivations of students. The outputs developed through such pursuits were contributed in the form of papers/articles in conferences and periodicals.

The activity was more focused on light as it was started in the International Year of Light 2015. The knowledge domain of light is close to

the life of almost everyone and has a rich interface of applications with theory at levels extending from school to advanced research. A series of articles was published in the local daily, *Hitavada*, as an output developed under this activity.

Though laboratory components of existing structures involve the aspect of learning by doing, the implementation leaves much to be desired as all students are expected (sometimes even compelled) to get similar results and the scope for individual creativity is severely curtailed.

Under our initiative, we involved students in learning by doing to quench

Table 3. Articles published in *Hitavada* on the eve of International Year of Light

Title	Date
Story of light	22/9/2015
Light through the lens of history	29/9/2015
Decoding the mystery of light	6/10/2015
Tapping the treasure of radiation	20/10/2015
Knowing where light comes from	27/10/2015
Learning light lightly	3/11/2015
Light plus light is not always light	10/11/2015
Lighting the world of eye	24/11/2015
Light for employment and empowerment	1/12/2015
Story of light for enjoyment and enlightenment	8/12/2015

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their curious queries. Learning was not governed by marks; a learner earned the credit only upon completion of the envisaged demonstration/project and as there were no fixed results there was hardly any scope for manipulation.

It is said that resources are limited but creativity is unlimited. If initiatives of open and flexible learning like the one discussed here are taken at grass root levels, they can unleash this creativity so that new fields, new industries and new employments can be continuously generated to cater to the vast spectrum of interests of our young demography.

Dr. Sanjay D. Jain is Head, Knowledge Center, Priyadarshini Institute of Engineering and Technology, Hingna road, Nagpur-19; Email: sanjaylambade@rediffmail.com
Mr Vivek M. Nanoti is Principal, Priyadarshini Institute of Engineering and Technology, Hingna road, Nagpur-19; Email: viveknanoti@gmail.com



A view of the Knowledge Corridor