should not disclose too many details of the research they propose to carry out, lest a better-equipped referee does the proposed research faster. Further, submission of such proposals may not be treated with the same confidentiality as is a manuscript submitted to a journal, with access being restricted and every access being recorded. As a futuristic proposal, the cell could help university researchers protect ownership of such original ideas that may have to be included when they submit research projects (at least within India). The protocol to be followed for this is outlined. Project principal investigators should be advised to submit to the concerned agency minimal skeleton outlines of their original ideas for research. More details should be submitted in a document to the cell which will carry an identification code, and the project proposal will refer to this identification code. A referee for the project proposal can, with authorization from the agency where the project is submitted, seek access which will be recorded with the cell. This provides an obvious safety feature, and could be extended to proposals submitted for beam-time allocation on big-science facilities. This suggestion, unlike the previous four, needs acceptance beyond the concerned university. Practicability of this suggestion would require support from the funding agencies and big-science facilities.

There are frequent statements on the quality of research output from our educational institutes, arguing that we must be better equipped and better funded. I feel that our ability to make impact is also dictated more by the 'originality level' of the research we undertake. As we challenge with newer ideas, rather than conform to template-based or 'me-too' research, we need to ensure visibility and claim priority. The proposed functions for plagiarism cells should be discussed in this light.

1. Chaddah, P., *Curr. Sci.*, 2012, **103**, 350.
2. Chaddah, P., *Curr. Sci.*, 2014, **106**, 349.
3. House of Commons Science and Technology Committee Report on 'Peer Review in Scientific Publications', Report HC 856, London, 28 July 2011.

P. Chaddah lives at E-26, RRCAT Colony, Indore 452 013, India.
e-mail: chaddah.praveen@gmail.com

Science education in India is dwindling: causes and potential remedies

Susanta Pahari

A major section of the students nowadays is drifting away from science education. Some of the past developments in the country along with the poor quality of human resources engaged in the education systems have wreaked havoc in the expansion of science education. Few measures have been taken recently at tertiary level to reverse the trend. Here, I emphasize on the measures which can help build solid foundation in the learning processes at the school level of education system to retain the glory of science education and research.

The first Prime Minister of India, Jawaharlal Nehru, envisioned the post-independent growth of our country and nurturing of its population through the advancement of science and technology. Accordingly, emphasis on science education from primary level to building quality science and technology institutes like the Indian Institute of Science (IISc) and Indian Institutes of Technology (IITs) at tertiary and research level were given priority. These efforts helped establish a good ecosystem of fundamental scientific research and development of technologies in the nation. IISc and IITs have emerged as internationally reputed institutes. Young meritorious students were attracted to pursue good quality science and technology courses in the country. However, developments like the establishment and quick expansion of information technology servicing industries from 1980s, liberalization of economy from 1990s and hence booming of real estate and associated industries and massive low-end job availabilities in these organizations have disturbed the ecosystem. As a result, a sharp polarization in the enrolment of students in commerce and allied disciplines is observed and science streams have taken a back seat. The enrolment in science disciplines is also gradually decreasing over the years. This is detrimental for a country like India, which aspires to be among the nations in the top league in the near future, because this cannot be achieved without scientific research and innovation.

Due to easy employment opportunities, the enrolment of students in professional courses like engineering was overwhelming some years ago. Several engineering colleges mushroomed in the country, approximately 3000 colleges in 10 years to meet the excess demand for engineering courses. However, it is gradually being realized that only approximately 25% of the engineering graduates from most of these newly established colleges are employable[1]. Further, the current economic slowdown has left several engineering graduates jobless. It has also been observed recently that only half of the total enrolled engineering students complete their course[2]. As only employability generally guides in the selection of a course, and not the interest or passion of the students, it will not be out of context to mention here that the last few years have witnessed a beeline for admission to the MBA course (supposed to be a gold standard for a greener pasture career) backed by graduation in commerce or business management and some lateral entry from science and engineering disciplines too. Again due to quality crunch, the fate has been the same; only 10–25% of the MBA graduates have got some kind of placement and the rest remain jobless. As a result, some mediocre B-schools in the country are gradually closing down[3,4]. At

this juncture, students and parents should wake up to the fact that it is far better to get a degree from a tier-1 science college rather than a tier-3 or -4 engineering or management college.

Recently, several programmes and fellowships have been instituted to train young, enthusiastic and bright students across the country with the idea to retain youngsters in science and motivate them to take up science as a career in future. One of these programmes is 'INSPIRE', supported by the Department of Science and Technology, New Delhi. In this programme, a five-day science camp is organized by various degree colleges and universities. Eminent scientists are invited to deliver lectures, interact with the students, undertake some practical sessions, etc. However, it is already being doubted whether this programme can reverse the trend[5,6].

Additionally, several new courses like the four-year degree course exclusively in basic sciences have been introduced by IISc, Indian Institutes of Science Education and Research (IISER) and some universities; however, the number of students who can enrol in these courses is limited. On the flip side, the same four-year degree course on basic sciences offered by other universities (e.g. Bangalore University) has received lukewarm response. Only a section of meritorious students enrol themselves in the four-year degree course in reputed institutions as their first choice. There may be some students who select this course, because they have not been able to get the required rank in the entrance examinations for professional courses like medical/engineering. However, both these group of students do not necessarily attend any stimulating programme like 'INSPIRE' to enrol in these courses. Therefore, the impact of these measures is not profound as expected to arouse mass attraction for science courses. As a result, majority of the students even today are opting for commerce or business-related courses.

The existing battered system of science education in the country is equally responsible for not attracting young students into the field. Therefore, it is the need of the hour to strengthen science education system from primary to tertiary level. Eligibility criteria of recruitment of new teachers need to be overhauled (in private education systems too) and an accountability measuring system needs to be urgently put in place. A permanent mechanism is needed for upgrading knowledge base and skill of the teachers and accomplished scientists need to be involved for this purpose. Intellectual isolation of the teachers from the rapid progress of science is one of the serious lacunae for decline in the quality of science learning process. Therefore, the productive scientist should be given the responsibility to teach and train the school/college teachers. This kind of teacher's training programme on a limited scale has been introduced by IISc, called the High School Science Teachers Training Programme.

In a recent report[7] it has been noted that majority of the school teachers who are having postgraduate degree (M Sc) failed in a test given on the first day of the training programme, confirming intellectual isolation of the teachers as a major factor affecting the quality of teaching. After ten days of intensive training, the performance of these teachers appeared to improve. This indicates constant training of school teachers in science subjects by accomplished professors or scientists is imperative. This will in turn help in establishing a solid foundation for the students and motivate them to choose science as a career. Scientists should also help in establishing reasonably modern laboratories (other than the regular school practicals) catering to a cluster of schools/colleges within a fixed perimeter or to a fixed number of students, especially in the rural areas of the country, if finance appears to be constraint in supporting individual organizations.

Some additional measures at the tertiary level, like feasibility of restructuring of the curriculum in science and engineering courses need to be taken up. Development of a course combining science and engineering (but with a different weightage) may give rise to a wider base to the students, which will help them in their job search, bring more intellectual completeness and application skills for pursuing their career. Besides this, choice-based credit system from undergraduate to postgraduate level needs to be introduced throughout the country. This will help science students combine one or two key papers from other disciplines (commerce, humanities, arts, law and sports). This mix and match will bring diverse experience among students and enrich the quality of any organization that they are going to serve in future.

Therefore, the best way to enhance the level of confidence of the young generation to pursue science is building a solid foundation in their primary and secondary levels of learning.

1. Only 25% IT graduates readily employable: Nasscom. *The Economic Times*, 7 April 2011.
2. Only 50% clear BE in four years. *The Times of India*, Bangalore, 2 April 2012.
3. Only 10% graduates employable despite robust MBA demand: Assocham. *The Business Standard*, 2 February 2014.
4. B-schools losing sheen as reality sets in, says study. *Deccan Herald*, 2 February 2014.
5. Koul, Monica, *Curr. Sci*., 2013, **105**, 145–146.
6. Singh, U., *Curr. Sci*., 2013, **105**, 750.
7. PU teacher scores 2/100 in chemistry. *The Times of India*, 25 January 2014.

Susanta Pahari is in the Indian Academy Degree College, Hennur Cross, Hennur Main Road, Bangalore 560 043, India.
e-mail: susanta2001@yahoo.com