

Indian science: concerns on competitiveness

The Prime Minister's address in January 2012 to the 44th Indian Science Congress started a debate on the overall status of Indian science¹⁻⁴. A recent report in *Science*⁵ speaks of excellence in space and nuclear science in India, and in institutions like IITs, IISc and IISERs. In spite of this excellence, our competitors like China and South Korea are progressing faster, leading to an overall gap in quality and competitiveness. Thus, the way forward is difficult, if not impossible. The mess created by the overseeing agencies like AICTE and MCI in the case of institutions of engineering and medicine is also in public domain. Similarly, the mushrooming of several universities under the aegis of the states without even a threshold level of infrastructure and faculty is also common knowledge. Another concern is the faculty shortage even in premier institutions. Recent concerns led to a realty check on the quality of school teachers. It was a rude shock to know that most of the teachers failed the Teachers Eligibility Test mandatory under the Right to Education Act. The very foundation of science education is crumbling. The problem has been further compounded due to tunnel-vision expansion with bare statistics in mind, bright students veering away from science and, essentially, saturation of science and education with mediocrity. It is germane to recall that we have the best recommendations in terms of science policy and vision statements. In spite of this, there is an overall impression of stasis and inertia. The problem of mediocrity from school to the highest level in education and research has been compounded by the archaic rules, regulations and bureaucracy². We have a vast pool of talent which prefers to move to courses like information technology and management due to a lack of mentors and role-models in science in school and higher education. We

hear platitudes like creation of centres of excellence or knowledge economy at regular intervals. It is great to hear words like 'innovation', 'creativity' or 'thinking out of the box'. However, these do not mean much without action which gives tangible results in a time-frame. Initiatives like INSPIRE fellowships have been started for spotting talent for scientific research. A regular impact assessment of such programmes is imperative.

In the backdrop of the above scenario, the following 'action plan' is urgently needed:

- Teaching creative thinking with emphasis on active learning rather than passive or learning by rote⁶.
- Implementing teaching methods where every student participates (rather than simply listening to the instructor)⁷.
- Emphasis on creative and critical thinking including inculcating the habit to question, develop opinions and the ability to think in a constructive way to improve upon the existing methods and designs.
- Encouragement at the school level to try out new things, doing things in an unorthodox manner, whenever feasible and question the conventional methods.
- Introduction of an appropriate system of evaluation of mentors by the mentees.
- Periodic 'health check-up' of institutions by surveys on the opinion of the students, research scholars and faculty on the issues which affect their career and growth and all issues related to the cultivation of science.

Doing science is more than doing a routine job. There has to be motivation and commitment. Thus, faculty hiring in schools and institutions of higher learning is the most crucial area which needs attention^{8,9}. Raghavendra Gadagkar, a

sociobiologist at IISc, quoted in the *Science* report⁵, says: 'Scores of universities are deteriorating or riddled with corruption. They nurture few stars and are overburdened with dead wood. On a day-to-day basis, people are discouraged from doing breakthrough research. Our system creates followers, not leaders.' A clear message should go by way of visible action that merit alone would prevail and that the non-performers would be discarded. The latter is needed to avoid accumulation of scum in educational and research institutions. One of the ways to achieve the objective of hiring and nurturing quality faculty is the American system of tenure track⁹. To quote Zare⁹: 'In the American university system we hire faculty and then must decide within seven years whether we want them permanently to remain with us, namely, are they given "tenure" or not. It is always a difficult decision as those faculty we tenure determine the *quality, characteristics* and *reputation* of our Department.' I am sure this would be one of the most important steps towards achieving global competitiveness.

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2. Jayaraman, K. S., 2012; <http://www.nature.com/news/indian-science-in-need-of-overhaul-1.9750>
3. Desiraju, G. R., *Nature*, 2012, **484**, 159–160.
4. Balaram, P., *Curr. Sci.*, 2012, **102**, 7–8.
5. Stone, R., *Science*, 2012, **335**, 904–910.
6. DeHaan, R. L., *Science*, 2011, **334**, 1499–1500.
7. Wieman, C., *Science*, 2009, **325**, 1181.
8. Singer, M., *Science*, 2009, **325**, 1047.
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Sharing of best practices or plagiarism?

If you visit the website of Indian Institute of Technology (IIT), Delhi¹, you will find the following vision and mission statements.

Vision: To contribute to India and the world through excellence in scientific and technical education and research; to serve as a valuable resource for industry

and society; and remain a source of pride for all Indians.

Mission: (i) To generate new knowledge by engaging in cutting-edge research

and to promote academic growth by offering state-of-the-art undergraduate, postgraduate and doctoral programmes. (ii) To identify, based on an informed perception of Indian, regional and global needs, areas of specialization upon which the institute can concentrate. (iii) To undertake collaborative projects which offer opportunities for long-term interaction with academia and industry. (iv) To develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

For higher educational institutes, working towards achieving these goals is a sure way of reaching their pinnacle. But if another institute or university is preparing its vision statement, can it use exactly the above wording in the document without acknowledging the source and still not be charged with plagiarism?

On the website of the National Institute of Technology, Patna², you will find that its vision and mission statements are exactly the same as those of IIT Delhi, without any reference to the source. This raises some questions. Can we consider such copying of vision and mission statements as simply sharing of best practices? After all, if another university finds that the vision statement of IIT Delhi is suitable for it, why not use the statement as it is? How much different can you write it anyway? Can we be less

lenient about it because such things are not done for any personal gratification? Since there are only limited English words available to rewrite the vision statement of IIT Delhi, is it alright for some other institute to copy it and claim it as theirs? Since the ideas expressed in the vision statement cannot be too different for each university, should we necessarily rewrite it differently just to avoid the charge of plagiarism?

Before we answer the above questions, let me bring to your notice an interesting case. The Southern Illinois University wanted to prepare a plagiarism policy after facing a plethora of incidents involving even its own university President for an alleged plagiarism in his Master's and Ph D theses. When the draft on plagiarism policy of the Southern Illinois University was ready, it was reported in the media^{3,4} that some parts of it have been lifted exactly word for word from a plagiarism policy document prepared by the Indiana University. How ironic! A plagiarism policy parts of which are plagiarised contents! The Southern Illinois University had to make suitable corrections by citing appropriate references including that of Indiana University⁵ in its plagiarism policy before adopting it.

As a perfect example to emulate, the mission statement of IIT Madras⁶ makes it clear that the broad outline of the statement is based on certain sources.

For example, it states that 'The Goals and Objectives were derived from the Sarkar Committee Report and embodied in the IIT Act. In addition to the Sarkar Committee report, the IIT act and the Statutes of the IITs indicate the lines along which IITs should develop' and goes on to explain the mission statement. Is not this approach much safer than simply copying someone else's vision and mission statements or policy statements? Is not some kind of attribution necessary when we borrow word for word the text or ideas as important as the vision statement or a policy statement from some other source? I think we need to be more circumspect about these sensitive issues.

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2. http://www.nitp.ac.in/vision_mission.htm
3. <http://chronicle.com/article/2-Universities-Plagiarism/1486>
4. http://www.usatoday.com/news/education/2009-01-29-plagiarism_N.htm
5. <http://www.siue.edu/policies/intro.shtml>
6. <http://www.iitm.ac.in/mission>

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Science teaching: from boring lecture to a performing art

I enjoyed reading the editorial by Balaram addressing an important topic of teaching that eloquently concludes by stating 'For young researchers, teaching must be a joy, not a chore to be avoided'¹. I would like to add that teaching must transform both teachers and students and such transformation can only come if teaching is done as a performing art². Teaching indeed is a theatrical art because teachers have got to interact with students and not introspect. Teaching not only requires subject knowledge, but also the ability to understand students' environment, including learning styles so that teachers can adapt to flexible modes of effective delivery.

Recently, I had a chance to observe teaching in India while reviewing an environmental science course (M Sc degree) in a university, where young sci-

entists preferred to use power-point presentations. It appears that most higher education teachers maximize the use of technology via power-point slides, videos, animations and virtual-reality tools that may enhance teaching, while triggering at times the audience to dose off naturally in dark classrooms. But the question is – do teachers rely more on technology and miss out vital classroom interactions? The power-point slides of science lectures can be easily downloaded from the net and it may ease teaching preparation. Nonetheless the technology alone will never leave long-lasting memory in the minds of students. Those who want to become teachers should recollect the names or faces of their own teachers back from their college days who had left an impressive memory in their minds, and all I could

remember now is two of my college teachers who had taught Shakespeare's drama in the early 1970s. Being great actors, they had left an ever-lasting memory in my mind, while many good science teachers faded away like the morning mist in distant memory.

Scientists have to integrate their dynamic public-speaking skills while delivering lectures. When they lack enthusiasm to perform in classrooms as actors while engaging the students, even the best scientists can become the worst teachers. Most institutes of higher learning now prefer to hire professors based on their scientific publications in high-impact journals and often ask potential candidates to give seminar presentations. Instead, if they give equal preference to teaching and if they assess candidates based on their acting and live performance