

Beyond irreverence

I enjoyed reading the editorial by Balaram¹ commenting on my editorial in *Science*².

Balaram states, 'the author, one of India's most visible, influential and articulate scientists chose the medium of the flagship journal of US science to present a provocative view forward for science in India'.

The fact is that I have been continuously writing about the need for irreverence in Indian science. For example, my article 'Chasing anomalies and discontinuities: the fun and joy of science' in *Current Science* way back in 2003 had the following to say.

In search of 'irreverence' in Indian science.

Science is an exploration of the nature of reality, both inside and outside us. The emphasis here is on things, which are

quantifiable and measurable and on theories, which can be tested and demonstrated; and facts, which can be observed and verified by others. Imagination plays a vital part in both science and art, but in science it has certain constraints. As Feynman has said: 'Whatever we are allowed to imagine in science has to be consistent with everything else that we know. The problem of creating something which is new, but which is consistent with everything which has been seen before, is one of extreme difficulty.' At the same time, the difficulty with science is often not with the new ideas, but in escaping the old ones. A certain amount of irreverence is essential for creative pursuit in science. I believe that if we promote that irreverence in Indian science, by change of personal attitudes, change of funding patterns, creating new organizational values, creating that extra

space for risk-taking. Respecting the occasional mavericks and rewarding the risk takers, then not only we will the fund and joy of doing science increase, but also Indian science will make that difference, that 'much awaited' difference.

I agree with Balaram that irreverence alone would not do. My article last year 'The grand challenges of Indian science' summarizes my views on what needs to be done 'beyond irreverence' (<http://beta.thehindu.com/opinion/op-ed/article/64716.ece>).

1. Balaram, P., *Curr. Sci.*, 2010, **98**, 1155.
2. Mashelkar, R. A., *Science*, 2010, **328**, 547.

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'Top scoring graduate' to 'top thinking graduate'

The current education system in India recognizes high test scores as the cornerstone for evaluation of talent. High scores determine the success of students in making a career of choice. This situation has put teachers under pressure and led to evolution of a typical Indian style of pedagogy that focuses on completion of syllabus at any cost (extra classes, exam drills and private tuitions) to make sure that the students consistently secure higher grades. The resulting examination anxiety has even affected the parents of young children and led to spread of strange practices like abstinence from non-vegetarian food, frequent visits to temples and churches, conduct of special pujas, fasting and turning to just about anything that will help their children pass with flying colours. Anxious parents enrol children as young as first graders into private tuitions after school and during weekends. Sample this: The Associated Chambers of Commerce and Industry has estimated the size of the Coaching Class Industry for the IIT entrance test to

be Rs 10,000 crore and the online tuition market is estimated to grow from a current worth of Rs 105 crore to Rs 1092 crore by 2012. Similarly, private coaching schools for other courses and entrance tests have also mushroomed and are banking on the anxiety of parents arising out of cut-throat competition to secure higher grades.

The pressure of heavy homework and long school days has made memorizing facts for examinations the most intellectual activity of the Indian student. This grind produces graduates lacking investigating and reasoning skills that are the basis for scientific excellence. Of many graduate peers, I have hardly come across few who are good at generating hypothesis, cross-connecting ideas and exploring the scientific literature to extract the essence of the facts even though most of them are high on motivation and work hard. This suggests that the methodology of Indian system of teaching is faulty at the base and cannot nurture scientific talent.

We are talking of achieving excellence in science and technology in the near future; I fear it is not possible as the Indian education system continues to produce graduates with ability to absorb existing facts but weak in thinking originally. A quote which summarizes my opinion 'In the US, you will find the best research oriented students at Stanford and MIT. In India, you will find the best research oriented students also at Stanford and MIT'. Before achieving our goals in science, we have to transform the current educational system at all levels so as to change it from one that produces 'top scoring graduates' to one that can produce 'top thinking graduates'.

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