

SCIENCE EDUCATION AND RESEARCH: INPUT TO NATIONAL EDUCATION POLICY, 2015

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Educate India : Challenges

- 665 Universities and 36,000 colleges
- Private to public : 70 : 30. In Andhra Pradesh and Telengana, share of private universities is ~ 80% !
- 30 million students enrolled in colleges and universities
- 80 % of students in undergraduate education; < 0.3 % in PhD programmes
- 1.34 million teachers with Pupil –Teacher Ratio of 23
- GER in higher education : 22 % ; from 12 % in Bihar to 45 % in Tamil Nadu
- Investment in education as % GDP : 4; Higher Education: 0.4 %(www.worldbank.org)

Higher education : Trends

- State progressively withdrawing from higher education
- Private sector and self financed institutions filling the space vacated by the state
- Opening of higher education space to foreign universities
- Private universities awaiting legislative approvals in many states
- Large number of students in affiliated colleges pursuing undergraduate education
- Vast disparities in access and quality

Issues that need attention

Balance between teaching and research; delivering frill free quality education at the lowest cost and preparing the student for a world beyond academia

Challenges in framing a policy : going beyond homilies

- Is one over-arching policy (one size fits all) cutting across India's diverse institutions of higher education feasible ?
- Should we have differentiated policy for institutions? Is “elitism” in education acceptable in India?
- Education is a state subject; implementation lies with the state. A centrally devised policy can be at best a guideline.
- Should the policy for science education focus only on undergraduate education? Is it necessary or pertinent to include post graduate education and PhD research in the policy given that this constitutes a miniscule portion of the students enrolled.
- Should we not define the “ winds of change” in our society to define the context of higher education in the next decades? What is different today that needs fresh ideas? Can we envision the world ten years hence when our current students will enter the work force? Are we preparing them for a world they are likely to encounter?

“Unless we understand the future for which we are preparing, we may do tragic damage to those we teach”

A. Toeffler, Learning for Tomorrow: The Role of the Future in Education, Vantage Press, New York, 1974

WHITHER SCIENCE EDUCATION IN INDIAN COLLEGES?

Urgent reforms to meet the challenges of a Knowledge Society

Dr. Catarina Correia | Dr. Leena Chandran-Wadia | Radha Viswanathan | Adithi Muralidhar



Students of the Pardhi community (a nomadic tribe) from Yamgarwadi, Maharashtra, explain the structure of DNA Sir Harold Kroto, Nobel laureate in Chemistry in 1986, during an interaction at a function organised by the Observer Research Foundation Mumbai

Foreword by Bharat Ratna Dr. C.N.R.Rao

“Every classroom in the country must echo with the excitement and curiosity of science”



Observer Research Foundation Mumbai

Ideas and Action for a Better India

State of Science Education

- *Poor quality of teaching*
- *Inadequate infrastructure*
- *Inadequate funding*
- *Low employability and poor career options*

Recommendations

- *Strengthening the university system and colleges*
- *Improving the quality of leadership*
- *Improving the quality of teaching*
- *Improving the accountability of teachers and institutions*
- *Improving the curricula*

2014

Whom are we teaching ?

How well have we understood the demands of the millennial generation?

- Attitudes
- Aspirations
- Mental stimulation
- Comfort levels with technology
- Engagement, involvement, interaction and social media

Making the transition from teacher centric to student centric education

Role of a research university : Dilemmas

- Student success vs faculty success
- Knowledge creation vs knowledge delivery
- The ambivalent faculty attitudes towards teaching
- Sage on stage vs mentor and coach on the side
- Pedagogy of learning : Practice and experiential vs text book and examination
- Education to make a living or education for living a life as a productive citizen
- Knowledge vs skills
- From STEM to STEAM : integrating arts, social sciences and humanities with S&T

Invigorating Education, K. C. Nicolaou, Angew. Chem. Int. Ed. 50, 63 (2011)



Time to Decide

The Ambivalence of the World of
Science Toward Education

Vikram Savkar
Jillian Lokere
Cambridge, Massachusetts
April 2010

nature EDUCATION
Position Paper

Sponsored by 

www.nature.com/scitable/forums/timetodecide

- Education is a charged and troubling topic for scientists at institutions of higher learning. Despite their personal feeling that education is important, many academic scientists eschew teaching in favor of research.
- Most universities despite having a publicly stated mission of education direct more funding, awards, and job security to outstanding researchers than to outstanding teachers.
- This ambivalence creates a divide between the professed values of the science community and our decisions, between the educational outcomes we hope for and the ways we allocate time and resources.

Is undergraduate research relevant in the Indian context?

- Inadequate pre university training in enquiry based education makes research training impractical for all undergraduates
- Undergraduate research only relevant to a select few
- A three year undergraduate programme hardly offers sufficient time for research in a laboratory
- Inadequate infrastructure for research in most institutions (faculties, laboratories)
- Expensive and unaffordable in most institutions
- A large proportion of career opportunities for undergraduates lie outside of academia; so why burden them with research ?
- Even in institutions offering a five year integrated programme with a year available for research, should all students be forced to do academic research ?
- Can we prepare the students for a world outside of academia? Such as, in law, media and journalism, management, entrepreneurship, school teaching etc ?

Universities in crisis

- American Universities at Risk, Richard N Zare, *Angew. Chem. Int. Ed.* 52,112 , 2013 : *Is higher education a private benefit to the individual graduates or a public necessity that benefits society at large ?*
- The End of the University as We Know It : N.Harden; <http://www.the-american-interest.com/2012/12/11/the-end-of-the-university-as-we-know-it/>, December 11, 2012 : *The higher education revolution is coming. Just a few decades hence, half the colleges and universities in the United States will have disappeared*
- The American Higher Education System is Spectacularly Inefficient, M. Nissen, [http://www.businessinsider.in/Americas-Higher-Education-System-Is-Spectacularly Inefficient/articleshow/23373939.cms](http://www.businessinsider.in/Americas-Higher-Education-System-Is-Spectacularly-Inefficient/articleshow/23373939.cms)

Crisis is a consequence of our inability to see the future; it has no relation to the relative levels of affluence or penury of a society

Excellence in universities is dependent on..

- Institutional Governance; balance between autonomy and accountability
- Diversity (social, ethnic, geographic, income, gender, language etc.)
- Financial resources
- independence of thought
- Quality of faculty
- Quality of students

Autonomy and accountability

- Government funded vs private universities
- If funded by Government, what should be the extent of autonomy ? How should Government create oversight mechanisms?
- What should be the governance structure of private universities or self financed institutions ?
- Autonomy for what : Curriculum and course design, hiring faculty, research focus; faculty compensation, student fellowships and stipends, where and how to spend the money?
- Accountability to whom: students, faculty, community, industry or political masters ?

Financial Resources

- Inter-se resource allocation for teaching and for research; What part of this must be subsidized by the state?
- How can our institutions raise resources outside of state support ? How do we build and manage endowments?
- Should higher education be subsidized for everyone? Can there be a more rational fee structure with support to those who cannot afford to pay?
- Do we need a new model of funding Universities? Government funded and Government managed, Privately owned and privately managed, publicly owned and managed by a public trust ?
- How can Government balance the resource demands of lifting the average against support to centers of excellence ?

Public funding of S&T is under stress worldwide. We need a new argument to sustain society's interest in and support for scientific research and education

PUBLIC FUNDING OF SCIENCE IS IN A CRISIS WORLDWIDE

Chemistry World, September 2014, p.7

NEWS AND ANALYSIS

Obama's science budget disappoints

US Funding falls to keep pace with inflation

US researchers and science advocates are expressing significant disappointment at funding proposals for research agencies in President Obama's budget request for 2015. The proposed increase only allows agencies to keep their headspace there, therefore the opportunity for new funding for chemistry and other disciplines will not be very bright, warns Glenn Rusklin.



Science advocates have been disappointed by the president's proposed budget

we can monitor, it's a strategic error that needs to correct says Research America president and chief executive Mary Woe. Many researchers have already been forced to adjust their life and staff planning research, clinical trials, leaving patients with more delay to access new treatments and therapies.

Flat cash They follow Democrat Bill Bernieris, Johnson, who serves the science, space and health committee, who stresses that research areas and agencies,

In its request for 2015, the president's budget asks for an increase of 1.2% from the current level. Meanwhile, non-defense R&D would receive \$63.9 billion, an increase of 0.4%, and basic research would receive \$32.1 billion, which represents a reduction of about 1%.

Science agencies the worst foreseen to be the Department of Energy, which would receive \$13.4 billion, an increase of 1.2% from the current level. Meanwhile, non-defense R&D would receive \$63.9 billion, an increase of 0.4%, and basic research would receive \$32.1 billion, which represents a reduction of about 1%.

Nevertheless, details about the administration's proposed budget remain elusive. For example, it is unclear how the requested funding increases or cuts for science agencies would be dispersed across program areas, and how much of the increase would be for the various scientific disciplines. In light of that it will likely have an overall budget deficit of \$1.1 trillion. Nevertheless, Rusklin calls the president's budget request a step forward because it shows the administration's intention to increase funding for science agencies.

Meanwhile, the research lobby has been comforted by the fact that the president has submitted to Congress, alongside his budget proposal, a separate \$16 billion Opportunity Growth and Security Initiative that would provide an extra \$2.1 billion for R&D activities. This would include an additional \$970 million for the NIH, \$686 million for NOAA and \$553 million for the NSF. But that proposal will need congressional approval.

Chemistry World, July 2014, p.6

NEWS AND ANALYSIS

Australian science base eroded by cuts

FUNDING Scientists defy decisions as policies

Australian research community is suffering from what has been described as short-sighted and politically motivated cuts, outlined in the new conservative government's budget.



Tom Ashby's government is eroding an AS10 billion medicine fund

Only medical research emerges as a real victor, with the erosion of AS\$10 billion (2.1 billion USD) by 2015, but several others will struggle to maintain research in Australia in the medium term, according to Ian Field, science policy adviser at the Australian Academy of Science. Field says the government "failed to realize that medical research needs underlying expertise in the chemical and physical sciences, and that support is being eroded".

Tom Ashby, secretary of the Australian Academy of Science, says the government's approach to funding is "short-sighted and politically motivated". He says the government is "eroding the science base" and "cutting research funding".

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Chemistry World, April 2014, p.9

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Chemistry World, July 2014, p.9

NEWS AND ANALYSIS

Scientists unsure about Modi

POLITICS New Indian government must address underfunding

India may have disappointed scientists in the Modi era, but Indian citizens have a science budget price that the country's growth and development. In 2014, the world's largest democracy, the scientific community is demanding a renewed focus on science.

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Universities cut to keep Australian science running

FUNDING Australian university

Australian university researchers are expressing concern about the impact of cuts to university research. The Australian Research Council (ARC) has announced a 10% cut in its funding for 2015, which will affect all research projects funded by the ARC.

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Government funding of science under stress; no country is the scientific community's satisfier!

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Portuguese chemistry faces disaster

FUNDING A third of academic chemistry labs could close

Portuguese research centres across scientific areas are facing a funding crisis. The Portuguese Chemical Society (SPQ) has announced that one-third of its research centres will be closed by the end of 2015.

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Chemistry World July 2015

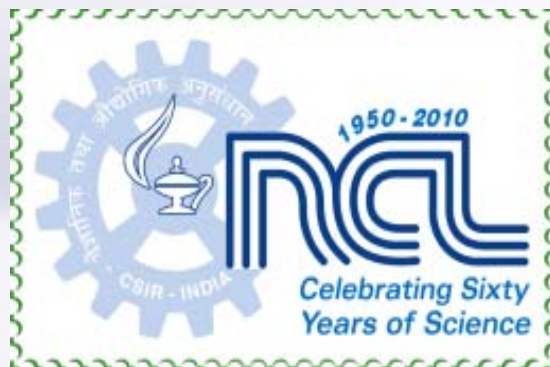
How do we measure excellence ?

- Why do we need metrics? What value does it bring?
- What should be the metrics?
- Should the metrics be designed within a socio-cultural context or excellence can be universally standardized?
- Is the current system of accreditation by NAAC appropriate?
- Can there be one metric for all Indian institutions?
- How will metrics be used ?

How should Government exercise oversight ?

- Monitor performance at periodic intervals
- Provide funding linked to institution's performance
- Minimally interfere in operational matters
- Provide full autonomy in all academic matters to the faculty
- Encourage and incentivize institutions to raise extra budgetary resources
- Ensure broad based self-governance structure involving faculty, students, academic peer groups, industry representatives and community leaders

Government must restrict itself to defining policies and guidelines, leaving much of the operational responsibilities to the university/institution itself



THANK YOU

