Falling through the cracks and bridging the gap – India and USA showing similar trends

Jayanta Chatterjee

Most countries in the world, including India and USA, have increased total number of research documents published. But average quality is falling and personal integrity of professionals is coming under more serious questions. Declining quality of education and research has grave socio-economic consequences in terms of worsening social mobility, consolidation of wealth and rising socio-political unrest. It is becoming apparent that quality of research has high correlation with 'corruption perception index' of a country. India and USA are showing similar trend in this regard. We should look beyond standardized test scores while selecting candidates for different courses and careers.

Keywords: Citation per document, corruption perception index, narcissism, social mobility, socio-economic discrimination.

COUNTRIES may differ in political ideology, governance pattern and social evolution, but many seem to have a sincere desire to establish knowledge economy to ensure future prosperity. Basic manufacturing or exporting raw materials (both human and natural resources) cannot achieve sustainable, long-term development. Many who were inspired by the impressive rise of BRICS (Brazil, Russia, India, China and South Africa) are equally worried by growing income inequality, poverty and social discrimination among its citizens[1] and the recent economic slowdown. Impressive growth of BRICS was possible mainly by satisfying the needs of more developed countries in North America and Europe. Influence of USA grew bigger as more people came in contact with American education, research and business establishments.

On the other hand, developed countries like the US also have an urgent need to improve social mobility; their ability to innovate and invent to maintain their social attractiveness and industrial competitiveness that historically translated into higher quality of living. The situation has begun changing in the US since the last few decades. Nobel Prize-winning American economist Joseph Stiglitz recently said, 'the US has one of the worst opportunity rates of any of the advanced economies. A child's life chances are more dependent on the income of his or her parents than most other industrial economies'[2].

The process to develop a productive knowledge economy would also be helpful to any democracy, including the two largest democracies in the world – India and the US, to build an informed electorate to have a vibrant and successful democracy.

Ever increasing number of publications from both India and USA was a matter of pride for many. But it is becoming increasingly difficult to ignore declining quality of published documents and growing threat to America's dominance in higher education and research. The way students are selected for different courses and candidates for different jobs is far from ideal. Time has come to look beyond standardized tests.

The relationship with corruption became clearer while analysing the issue. More transparent nations tend to do better in higher education and research. This leads to the question – who are the people left behind and what are the long-term consequences? It also provides clues on why a major part of our student community started showing traits like narcissism. It reflects the changing nature of our society and how students from less privileged background adjust to such changes. Currently, successful and talented students are more attracted towards wealth management than wealth creation – deviating from the tradition that contributed to most Western countries becoming prosperous.

The knowledge and technological gap between developed countries like the US and developing nations like India is narrowing down. But the gap among people from different socio-economic strata within the countries is increasing. Education and scientific research would help us finding a better way to improve our declining social mobility, bridge the gap between students from different socio-economic backgrounds to ensure sustainable long-term, all-inclusive development of the world that we live in.

The author lives at 1280 Prospect Commons, Sun Prairie (Madison), Wisconsin 53590, USA.
e-mail: jay62728@yahoo.com

Number of published documents increased but average quality declined

India witnessed a significant increase in total number of publications just like most, if not all, other countries in the world. This is one of the consequences of increase in the number of journals and spread of highly profitable academic-research publication industry[3]. Total number of documents published from India increased from 20,600 (citable documents 20,312) in 1996 to 98,081 (citable documents 91,366) in 2012, improving its ranking from 13 to 7 (ref. 4). It wrongly provoked many to celebrate. We seem to be blissfully ignorant or conveniently forget that average quality of publications, measured in term of 'cites per document', is still low and declining. Publication of lower quality documents has increased, as measured by the increasing ratio of non-citable versus citable documents. The average citation per document published from India was 9.91 in 1996. It came down to 0.26 in 2012 (ref. 4). Due to some yet unidentified reasons, the rate of decline specifically worsened after 2009. The trend is reflected in every branch of science, including agriculture, biology and molecular biology. This may be due to two reasons. First, increase in the number of low-quality documents being published, while that of higher quality ones remained the same or increased but not proportionately. Alternatively, the number of higher quality citable publications declined too. The exact reason(s) could not be ascertained from the dataset.

During 1996, the year when systemic data collection started, India's global ranking was 31 (out of 35 countries), and the top position was occupied by Switzerland followed by USA as far as quality is concerned. In 2012, India's ranking came down to 52, USA was at 16 while UK retained its 8th position and Switzerland its top position, out of 57 countries[4]. This raking is based on cites per document with countries publishing at least 3000 documents in 'all subjects' during that year. It is obvious that average quality of publications varies based on subject area, but generally follows a trend. The declining trend is reflected in agriculture and biological sciences too, where India was ranked 15 in 1996 and slipped to 36th position in 2012 (ranked according to 'cites per document' with countries publishing at least 1000 documents in that sub-category). Table 1 shows relative ranking of India and USA in 1996 and 2012 (adapted from ref. 4). It also mentions the country that occupied the top position in any specific subject area in that year. Here we need to keep in mind that USA has the largest infrastructure in higher education and research followed by India[5] and these two largest democracies in the world show a similar trend, not identical though.

Here I should mention that *h*-index, another popular measure to quantify scientific output, is not used for several reasons. The main reason being scientists/countries with shorter career are at an inherent disadvantage, regardless of the importance of their discoveries or publications. Had Einstein died after publishing his four ground-breaking publications in 1905, his *h*-index would be stuck at 4 or 5. This is a problem for any measure that relies on the number of publications.

Such academic documents do not tell the whole story as one of the major parameters, patent data, is absent. Since most patents in high-tech areas originate from peer-reviewed publication we see a similar trend there. Like many peer-reviewed publications, successful granting of patents does not guarantee quality or usefulness of a scientific research. We can get an idea from the fact that about 80,000 of granted patients which took part in clinical trials based on research were later retracted because of 'mistakes or improprieties'[6].

It will be naïve to assume that quantity would guarantee quality unless actual objectives of the researcher(s) are clearly defined and accountability enforced. The outcome probably would not change much by simply making the current screening system more stringent, e.g. increasing the cut-off mark or test score.

Looking beyond standardized tests

Many believe that most successful students have less appetite to take risk that might jeopardize their otherwise successful career. They hesitate to undertake so-called 'disruptive' research that we hear so often these days. Many are afraid, sometimes ashamed, to deviate from established practices to encounter 'failure'. The same seems to be true for business courses and entrepreneurship. Highly standardized tests (e.g. CSIR–UGC NET, ACT, SAT, GMAT, GRE, etc.) select students who are groomed to excel as an individual with specific skill set. Such skills can be improved to a great extent by private tuition, professional coaching and practice[7]. Students from a privileged background can also take such (expensive) tests multiple times. It is believed that students' average test scores in USA rise with every additional US$ 20,000 family income[8]. One study in the UK found that brilliant kids from less-affluent families were on average two-and-a half years behind their peers from a more affluent background[9]. The trend seems to be the same in many other countries including India[5]. These tests never evaluate a candidate's social consciousness, grit, curiosity, passion, team work, leadership quality, innovative thinking and, most importantly, personal integrity. We conveniently forget that these skills and attitude have more impact on our societies and organizations, including for-profit ones to succeed in the long run[7,10].

Many Indians can see the consequence more clearly during selection of top bureaucrats in India through, arguably, one of the most competitive selection processes in the world, with less than 0.3 per cent success rate. Yet reports suggest that 'Indian's bureaucracy is the worst in Asia'[11].

Table 1. Ranking of countries based on quality of published documents (cites per document) with at least 1000 documents

	India		USA		Top rank	
	1996	2012	1996	2012	1996	2012
Agriculture and biological science	15	36	7	14	Sweden	Switzerland
Biochemistry, genetics and molecular biology	22	36	2	11	Switzerland	Switzerland
Chemical engineering	7	14	3	4	France	The Netherlands
Chemistry	15	24	2	3	Switzerland	Singapore
Computer science	15 (2004)*	27	1 (2004)*	10	USA (2004)*	Sweden
Engineering	14	33	5	18	Switzerland	Denmark
Earth and planetary sciences	12	22	1	11	USA	Chile
Environmental science	13 (2004)*	26	6 (2004)*	12	Sweden (2004)*	Denmark
Immunology and microbiology	15 (2003)*	17	2 (2003)*	7	Switzerland (2003)*	Switzerland
Mathematics	10 (2003)*	29	1 (2003)*	18	USA (2003)*	Switzerland
Medicine	24	45	5	16	Canada	Belgium
Physics and astronomy	18	38	1	29	USA	Greece
All subjects (countries with at least 10,000 documents)	17	40	2	16	Switzerland	Switzerland

*The year when India first appeared in the list of countries with at least 1000 published documents in the subject.

We are aware of the Indian health care system and malpractice by some doctors. But probably not many Indians or even Americans are aware of similar medical malpractice by American doctors, who belong to one of the most financially remunerating professions in USA. It is reported that more than 90 per cent of doctors in the US receive favours from drug companies[12]. An independent non-profit (non-governmental) organization, ProPublica, tracks different doctors and drug companies in the US. It estimated that since 2009 more than US$ 2.1 billion has been paid to different health professionals by only 15 drug companies who voluntarily participated to disclose the information[13]. The good news is that the new health care reform (Affordable Care Act, 2010) by the American government mandates all pharmaceutical and medical device companies to publicly disclose any financial relationship with the doctors and other health care providers beginning 2014 (ref. 13).

Incidences of scientific misconduct, acceptance of such misconducts among scientific community and academia are increasing[3]. Reproducibility and trustworthiness of even 'landmark' research and publications have reached worryingly low levels. The biotech company, Amgen, found it could reproduce only 6 of 53 such 'landmark' studies in cancer research. Previously, a group at pharmaceutical company Bayer managed to repeat just one-fourth of 67 similarly important papers[6].

Many researchers are more interested to obtain grants (mostly public money) only for data cranking and publication. Developing novel technology, new products and contributing to solving relevant social and national issues seem to be less important in the era of 'publish or perish' and cut-throat competition[3]. It discourages many able and honest scientists to undertake challenging, risky research and provokes them to engage in routine survey or -omics type of work that practically guarantees faster publications. Increasingly prolonged education and training along with reducing independence weeds out many imaginative, spontaneous, truth-seeking scientists in favour of socially adept, agreeable and industrious candidates.

Now many business leaders, venture capitalists and policy makers find it hard to trust scientists. Students and scientists adhering to a higher standard of personal integrity and professional ethics are now under more threat than ever before. Such lack of trust, deficit of manpower with high professional ethics and personal integrity invariably affect government policies, particularly regarding private industries dealing in scientific and high-tech areas like public health care, energy, biotech, space research, etc. Efforts to make productive policies (both public and corporate) and enforcing laws that require in-depth scientific understanding and technological knowledge are among the obvious victims.

Corruption perception index has high correlation with quality of research

There is a general perception that more open and transparent societies generally perform better so far as quality of research is concerned. Indeed, a high correlation can be established by plotting corruption perception index (CPI)[14] against citation per document (CPD)[4], as shown in Figure 1. It is based on 57 different countries that published at least 3000 documents in 2012. A country having higher CPI indicates more transparency and less corruption. The correlation coefficient between CPD and CPI is an astounding 0.768. It means that about only 23.2 per cent variation is due to other factors. This does not automatically imply that these two parameters are directly connected or establish a causal relationship. It can also be due to common factor(s) influencing both the issues.

It should be mentioned here that no significant correlation was found using *h*-index. Similarly, no significant

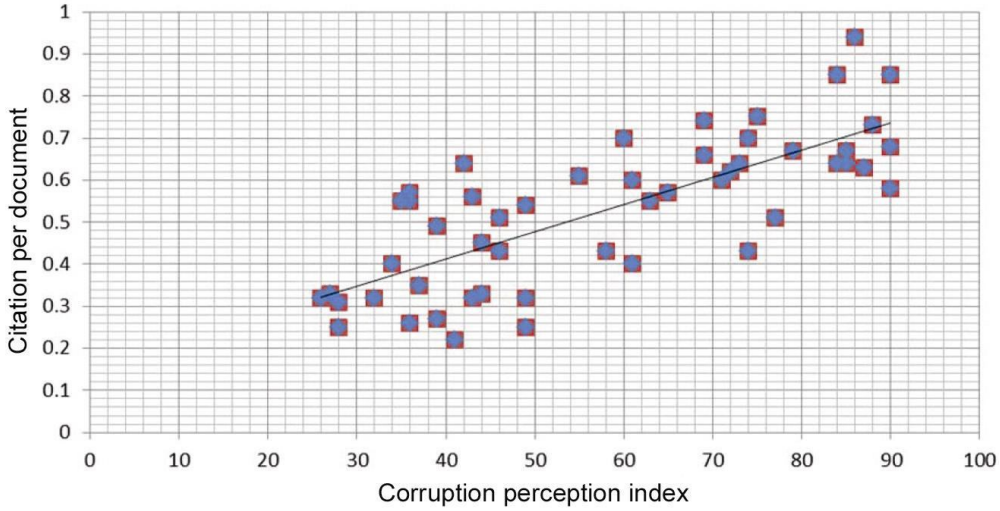

Figure 1. High correlation between average quality of documents published (citations per document) with transparency (corruption perception index) with a correlation coefficient of 0.768.

correlation between CPD and GDP or GDP per capita of a country (retrieved from CIA website: www.cia.gov) could be established.

Falling through the cracks

The number of science doctorates earned each year grew by nearly 40 per cent between 1998 and 2008 in the member countries of the Organization for Economic Co-operation Development (OECD), that include both India and the US. It is believed that many countries, certainly USA, are producing more Ph Ds than they need[15]. It implies that many students in the US with the highest academic degree, Ph D, may not remain unemployed, but are certainly underemployed.

The bigger picture becomes clearer if we consider data from the Association of American Medical Colleges. It shows that over 60 per cent of medical students in the USA come from families that belong in the top quintile of household income. The median annual family income of American medical students is over US$ 100,000 (ref. 16), in total contrast to 1971 when 30 per cent of medical students came from households with income in the lowest 40th percentile. Now only about 10 per cent of all medical students come from the lower half of American society[17,18].

Evidences of declining rate of innovation and invention[19], worsening social mobility, consolidation of wealth in fewer hands in developed countries like the US and the UK[20–22] are some of its inevitable consequences. Tendency to make higher education just another for-profit industry is spreading fast[3,23–25]. Now about 76 per cent of college instructors in the US are part-time staff with very low salary and benefits, replacing full time faculties. That enable the colleges to save a lot of money at the cost of quality of education[26]. This trend started around mid 1970s. We see the same trend in India too. Now many American colleges and universities, mainly the private ones, are more interested in attracting students not only from the US, but also from around the world who can pay higher tuition fee, build influential alumni to increase its endowment fund and get (government) grants. Many faculty particularly the 'successful' ones, are less interested in teaching and mentoring[23,27]. At least a part of the high cost of hiring reputed administrators and faculty is passed onto the students. It just adds one more layer to the already insanely expensive higher education in the US, which cannot be justified by either falling quality or grim future prospect of a well paid job. This is one of the reasons why about 79 per cent of American students earning four-year bachelor's degree come from families whose annual income is among the top 25 per cent. Only 11 per cent of students from families with bottom 25 per cent income group[24].

In his famous book *The Price of Admission*, Pulitzer Prize-winning journalist and Harvard alumni Daniel Golden shows 'how America's ruling class buys its way into elite colleges and universities – and who gets left outside the gates'. On the other hand, public schools and universities are more interested in retention and rate of graduation than providing quality education with stringent evaluation[23]. Compromising on evaluation and lowering the quality bar to make almost everyone feel like a genius may not be a great idea after all.

Rise in narcissistic attitude among students

Our effort to make our children and students more confident has increased narcissistic attitude to an 'epidemic level', at least among students in colleges in USA[28], even

though evidences suggest that there is no correlation with high confidence level and future success[29]. A similar trend is observed among students in 'elite' institutions in India too.

Economic, socio-cultural background and changing demography do play a role in such personality traits. A recent study showed that: (i) people from higher socio-economic classes are more narcissistic than those from lower socio-economic classes; (ii) persons from only-child families are more narcissistic than those from families with multiple children; (iii) people from urban areas are more narcissistic than those from rural areas and (iv) individualistic values are predictive of individual differences in narcissism[30].

Changing nature of both Indian and American societies towards smaller families, increasing representation of students from affluent privileged background, mostly from urban areas are either causing or adding to this epidemic.

Generally speaking, the narcissists are outwardly charming and charismatic. They find it easy to start relationships and show more social confidence in job interviews[28,29]. It is becoming more important in this era of networking. But such an attitude may not be good for learning, to build teams and to reach consensus towards a common objective based on facts and logic. It has profound negative implications for workplace environments[31].

Wealth management versus wealth creation – a growing gap

A recent US Department of Labour report indicates that only 5 per cent of American workers are employed in fields related to science and engineering; yet they are responsible for more than 50 per cent of its sustained economic expansion. About 40 per cent of college students planning to major in engineering and science end up switching to other subjects[32]. Many, if not majority, of successful young students in schools and colleges are now attracted towards careers that are more financially lucrative and not towards science, technology, engineering and mathematics (STEM). It will not be unfair to say that many talented students and professionals are now more attracted towards wealth management than wealth creation. Courses and careers in business, management, finance and economics are more attractive than pursuing a career in humanities or creative arts, science, engineering and technology, higher education and research.

It is not surprising that only 32 per cent of the US high-school students in 2011 are ready to attend college[33]. About 25 years ago, USA led the world in high school and college graduation rates. Now it has dropped to 20th and 16th position respectively[34]. It is not only the quantity, but also quality that is affected. Now American students rank 23rd in mathematics and 31st in science compared with 65 other top industrial countries[34].

We can see the same trend in India as well. The quality of education being imparted in Indian schools has proved far below average in an international rating system for schools from 74 participating countries. Programme for International Student Assessment (PISA), introduced by OCED, is an internationally standardized procedure that tests 15-year-olds in the domains of reading, mathematical science and science literacy. Two representative states from India participated. Himachal Pradesh was at the very bottom of the list, while Tamil Nadu, one of the most lauded states for its education, ranked near the bottom in all categories, outscoring only Kyrgyzstan and Himachal Pradesh[5,35]. India now ranks 78 out of 123 countries in terms of literacy. India's human development index now ranks 134 out of 187 countries. Now only 15 per cent of Indian graduates, out of three million, are suitable to be employed in blue-chip companies[5]. Changing social values and neglecting basic education have taken a toll on higher education and research.

Bridging the gap

It is widely accepted that knowledge gap between the developed and at least a few developing countries (mainly BRICS) is narrowing. However, BRICS and other developing nations must be cautious of portable pitfalls, learn from both the successes and failures of more developed countries like the US to adjust in a changing world where no science superpower is expected to dominate or follow[36].

It also assigns more responsibility, than ever before, on developing countries to carry out their global responsibilities on issues like global warming, energy crisis, food and water security, social mobility to tame the growing socio-political unrest. These issues are becoming more interconnected and affect almost every country and its citizens. It becomes more urgent for developing countries like India compared to developed countries like the US who traditionally show higher flexibility to accepting, analysing and implementing corrective measures. But one challenge seems to be the same for both the countries. Both developed and developing nations need to prepare a different kind of work force and professionals (for both public and private organizations) to successfully face the challenges of our changing world. The process to make such a change would also be helpful bridging the growing gap between people from different socio-economic strata within a country.

Conclusion

Declining social mobility, growing income inequality, public discontent and frustration mainly among younger

generation raise concern for both future economic prosperity and national security. Importing manpower from abroad, particularly for routine jobs, cannot be a long-term sustainable solution for developed countries like the US, as they also face serious challenges regarding unemployment and underemployment. It hurts the source country like India as well. Generally, it acts against the long-term national interest to groom its own potential, talent and industrial competitiveness. It also works against honest and talented students from less privileged background in the developing countries like India. A more detailed discussion is beyond the scope of this article.

There must be something wrong in the way we now select, groom, promote and remunerate talented students. It also raises some serious questions. How can we increase efficiency and productivity by attracting better students who have the desire and ability to excel, and to contribute to the society and the subject?

During the last few decades many in Indian higher education and research sector are loudly asking for everything more and the country simply does not have enough resources to satisfy all[37]. We hear similar demands in the US, particularly during the current era of economic hardship. There is no doubt that government R&D budget and money coming into higher education and research has increased significantly – both in India and USA. The US continues to spend the most on R&D with US$ 465 billion (2.8 per cent of GDP), while India ranks eighth in the list with US$ 44 billion (0.9 per cent of GDP) in 2013–14 (ref. 38). Global R&D spending is expected to increase to US$ 1.62 trillion, while both India and the US are expected to maintain their current percentage of GDP to be spent on R&D. This implies increase in monetary value as both the economies are growing at a modest rate. Salary and other financial benefits have increased significantly as well. However, such increase is not reflected in societal well-being, quality of higher education and research so far.

Many critics argue that the increase in financial remuneration has attracted many unworthy candidates, who probably would be better in areas other than academics or research. If survival and progress of a person in a specific area is not dependent on actual productivity and accountability, then mere hike in monetary benefit to individuals, increasing research grants using tax-payers' money, would do more harm than good. It is now being argued that higher remuneration improves performance only for mechanical or routine jobs, while reducing the performance when, even, rudimentary cognitive skill is needed[39] (a cartoon presentation is available at http://www.youtube.com/watch?v=u6XAPnuFjJc). Post World War II 'input–output model', where monetary input was assumed to be directly proportional to knowledge output seems not to be true anymore[3,40].

It is obvious that the best groomed candidates are not always the best candidates for a course or a job (avoiding the term 'career' here). Currently, we are losing many gifted individuals and natural leaders if their talent, personal integrity and leadership quality are not backed up by their privileged background. In the long run it would affect our economic prosperity with rising socio-political unrest, eroding trust on political, academic and business leadership.

The issues discussed here are not unique to India or the US. It is present in many other countries, mainly in the developing world. Producing workers to cater to the needs of industries and other employers is an important objective. But we, as part of a society, would face huge socio-political consequences if that objective is applied to students based on their socio-economic background, or if it becomes the sole objective of our education. Our effort to establish an informed electorate and knowledge-based economy with the goal to provide better quality of living and prosperity for our citizens would be better served otherwise.

1. The Organisation for Economic Co-operation and Development (OECD), Special focus: inequality in emerging economies. 2011; http://www.oecd.org/social/soc/49170475.pdf
2. BBC News, Davos 2013: Joseph Stiglitz attacks US 'inequality'. 2013; http://www.bbc.co.uk/news/business-21183987
3. Chatterjee, J., India needs to be cautious while following the American model of higher education and research. *Curr. Sci.*, 2011, **102**, 1500–1501.
4. SCImago, SJR – SCImago journal and country rank using Scopus data source. 2013; from http://www.scimagojr.com (retrieved on 6 November 2013).
5. Chatterjee, J., Primary and secondary education reform should be the top priority for India. *Curr. Sci.*, 2011, **103**, 356–358.
6. How science goes wrong: Scientific research has changed the world. Now it needs to change itself. *The Economist*, 2013; http://www.economist.com/news/leaders/21588069-scientific-research-has-changed-world-now-it-needs-change-itself-how-science-goes-wrong
7. Strauss, V., What do SAT, ACT scores really mean? *The Washington Post*, 2012; http://www.washingtonpost.com/blogs/answer-sheet/post/what-do-sat-act-scores-really-mean/2012/09/24/33e341c0-0675-11e2-afff-d6c7f20a83bf_blog.html
8. Layton, L. and Brown, E., SAT reading scores hit a four-decade low. *The Washington Post*, 2012; http://www.washingtonpost.com/local/education/sat-reading-scores-hit-a-four-decade-low/2012/09/24/7ec9cb1e-0643-11e2-afff-d6c7f20a83bf_story.html
9. Harrison, A., Class divide in boys' reading skills seen in Pisa scores. *BBC News*, 2013; http://www.bbc.co.uk/news/education-23271555
10. Paul, T., *How Children Succeed: Grit, Curiosity, and the Hidden Power of Character*, Houghton Mifflin Harcourt, New York, 2012.
11. *BBC News*, India's bureaucracy is 'worst in Asia'. 2012; http://www.bbc.co.uk/news/world-asia-india-16523672
12. Roehr, B., More than 90 percent of US doctors receive favours from drug companies. *Br. Med. J.*, 2007, **334**, 869–872.
13. ProPublica, Dollars for docs – how industry dollars reach your doctors, 2013; http://projects.propublica.org/docdollars/
14. Transparency International, Corruption perceptions index 2012; http://cpi.transparency.org/cpi2012/results/
15. Cyranoski, D., Gilbert, N., Ledford, H., Nayar, A. and Yahia, M., Education: The PhD factory. *Nature*, 2013, **472**, 276–279.

16. Association of American Medical Colleges, Medical educational costs and student debt: a working group report, AAMC, Washington DC, 2005; http://www.neomed.edu/students/es/finaid/secure/step5/edcostsanddebt.pdf
17. Steinbrook, R., Medical student debt – is there a limit? *N. Engl. J. Med*., 2008, **359**, 2629–2632.
18. Chen, P. W., The hidden costs of medical student debt. *The New York Times*, 2011; http://well.blogs.nytimes.com/2011/07/28/the-hidden-costs-of-medical-student-debt/?_r=0
19. Sarewitz, D., Science agencies must bite innovation bullet. *Nature*, 2011, **471**, 137.
20. Miles, C., Income inequality, equality of opportunity, and inter-generational mobility. *J. Econ. Perspect*., 2013, **27**, 79–102.
21. Adam, B., McCarty, N., Poole, K. T. and Rosenthal, H., Why has not democracy slowed rising inequality? *J. Econ. Perspect*., 2013, **27**, 103–124.
22. Chetty, R., Hendren, N., Kline, P. and Saez, E., The equality of opportunity project, 2013; http://obs.rc.fas.harvard.edu/chetty/website/IGE/Executive percent 20Summary.pdf
23. Public Broadcasting Service, USA, Declining by degrees: higher education at risk – a PBS documentary, 2012; http://www.youtube.com/watch?v=BcxDVYo2wH8
24. Fisher, D., Poor students are the real victims of college discrimination. *Forbes*, 2012; http://www.forbes.com/sites/danielfisher/2012/05/02/poor-students-are-the-real-victims-of-college-discrimination/
25. Cohen, S., The three biggest lies in college admission. *Forbes*, 2012; http://www.forbes.com/sites/stevecohen/2012/09/29/the-three-biggest-lies-in-college-admission/3/
26. Curtis, J. and Thornton, S., Annual Report on the Economic Status of the Profession, American Association of University Professors, 2013, p. 8; http://www.aaup.org/file/2012-13Economic-Status-Report.pdf
27. Bhattacharjee, Y., Postdoctoral training. NSF, NIH emphasize the importance of mentoring. *Science*, 2007, **317**, 1016.
28. Twenge, J. M. and Foster, J. D., Birth cohort increases in narcissistic personality traits among American college students, 1982–2009. *Soc. Psychol. Pers. Sci*., 2010, **1**, 99–106.
29. Twenge, J. M. and Campbell, W. K., *The Narcissism Epidemic: Living in the Age of Entitlement*, Atria Books, New York, 2009.
30. Cai, H., Kwan, V. S. Y. and Sedikides, C., A sociocultural approach to narcissism: the case of modern China. *Eur. J. Pers.*, 2012, **26**, 529–535.
31. Westerman, J. W., Bergman, J. Z., Bergman, S. M. and Daly, J. P., Are universities creating millennial narcissistic employees? An empirical examination of narcissism in business students and its implications. *J. Manage. Educ*., 2012, **36**, 5–32.
32. Adkins, R. C., America desperately needs more STEM students. Here's how to get them. *Forbes*, 9 July 2012; http://www.forbes.com/sites/forbesleadershipforum/2012/07/09/america-desperately-needsmore-stem-students-heres-how-to-get-them/
33. Increasing the achievement and presence of under-represented minorities in STEM fields, National Math + Science Initiative, USA, 2013; http://nms.org/Portals/0/Docs/WhitePaper/NACME%20-white%20paper.pdf
34. Dillion, S., Top test scores from Shanghai stun educators. *The New York Times*, 2010; http://www.nytimes.com/2010/12/07/education/07education.html?_r=0
35. Walker, M., PISA 2009 Plus results. Performance of 15-year-olds in reading, mathematics and science for 10 additional participants. Australian Council for Educational Research, 2011; http://research.acer.edu.au/cgi/viewcontent.cgi?article=1000&context=pisa
36. Rogers Hollingsworth, J., Muller, K. H. and Hollingsworth, E. J., China: the end of the science superpowers. *Nature*, 2008, **454**, 412–413.
37. Balaram, P., Science in India: New Year Reflections. *Curr. Sci.*, 2012, **102**, 7–8.
38. 2014 Global R&D funding forecast. *Battelle R&D Magazine*, 2013; http://www.rdmag.com/sites/rdmag.com/files/gff-2014-5_7 percent20875x10_0.pdf
39. Pink, D. H., Drive: *The Surprising Truth about what Motivates Us*, Riverhead Books, New York, 2011.
40. Sarewitz, D., Double trouble? To throw cash at science is a mistake. *Nature*, 2010, **468**, 135.

ACKNOWLEDGEMENT. I thank Surjasikha Ganguli, Data Governance Analyst at Dean Health Plan Inc., Madison, WI, USA for help in data analysis.

Received 2 January 2014; accepted 17 January 2014