Lessons in science education

Strong science education is an important part of any modern education. To ensure scientific progress, however, students need to aspire to academic careers.

Education forms a substantial part of the $787 billion American Recovery and Reinvestment Act, signed by Barack Obama on 17 February this year. A total of about 100 billion US dollars is allocated for education-related programmes[1,2]. This includes significant portions of a $54 billion public sector fund to prevent teachers from being laid off[3], as the entire US school system was in danger of collapse with the threat of over 500,000 job losses in schools[4]. Furthermore, large portions of these funds will be spent on modernizing schools and improving early childhood development, as well as providing tax credits and tax breaks to make college more affordable for students from poor backgrounds.

What better place than research labs to inspire teenagers in science?

Even though such measures are unlikely to yield short-term gains, they are invaluable for the long-term scientific and technological development that is the basis for innovation and economic wealth. It is these long-term aspects in which the scope of Obama's stimulus package is different from economic rescue programmes discussed and implemented in other countries, such as Germany or the UK, where money is mostly awarded to short-term measures aimed at kick-starting the economy.

Although improvements to US school infrastructure and teachers' salaries are desperately needed, particularly in poorer regions, an area that remains in urgent need of improvement is school education. There needs to be stronger emphasis on a good science curriculum. According to data from the OECD's 2006 PISA assessment study, the science literacy of 15-year-old students in the US ranks only in 23rd place out of 41 nations studied[5].

The problem is not confined to the US but is endemic in many other developed countries. Although the UK, for example, lies in a seemingly better 12th place in the same OECD study, a recent survey conducted by the UK Royal Society of Chemistry observed an erosion of standards in chemistry education[6]. Such a drop in standards may in part be a consequence of the continuing unfortunate situation that in many UK state schools science is only offered as a single subject, a far cry from the comprehensive and intensive curriculum standards in those countries coming out on top of this comparison — Finland, Japan, Hong Kong and Korea.

There are many ingredients to good science education: qualified teachers educated to the latest standard of scientific knowledge, a comprehensive curriculum that provides a broad scientific overview and supports creative thinking, well-equipped school laboratories where students can learn science in a practical way, and good textbooks that illustrate scientific concepts in a suitable and exciting fashion.

The importance of these criteria for good science education at schools is certainly well understood. Unfortunately the problem for many schools remains obtaining sufficient funds in support of such ideals. The near-disaster in the US of losing many school teachers is merely a point in case.

There is another crucial ingredient for successful scientific education: to get the students interested in the topic. Science, particularly in the physical sciences, is much less a part of everyday life than, for example, law or economics. Probably very few students have even a basic understanding of how many scientific breakthroughs are at the core of modern products such as smart mobile phones or high-density storage media.

Therefore, it is important to convey experience of scientific research, and the excitement of state-of-the art scientific research. Examples of public outreach are science fairs at US high schools, international science Olympiads and exhibitions such as *Strange Matter*, organized by the Materials Research Society[7]. Another notable scheme is PhysiScope, based at the University of Geneva in Switzerland. In his Commentary on page 245, Christoph Renner describes this initiative[8], where teenagers experience practical experiments centred on advanced scientific concepts such as superconductivity. The experiments are conducted by PhD students and postdocs, and the venue is

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embedded within the physics department, so that students can also peek into the research labs. What better place to inspire students with the work of scientists?

Although to sustain initiatives such as the PhysiScope a substantial long-term financial commitment is required, its impact should not be underestimated. Innovation and technological progress require an educated work force that has been given a firm understanding of scientific principles; and if we are to motivate gifted students to take up an academic career in the sciences, they need to be inspired and their curiosity awakened.

A sound strategy for science education therefore needs more than a good financial basis. To stimulate interest in an academic career, students need to be encouraged and supported from an early age. Public outreach programmes are essential, and scientists' duties as teachers begin far sooner than with beginners' classes in college. ❐

References

1. http://www.recovery.gov
2. http://www.ed.gov/policy/gen/leg/recovery/factsheet/overview.html
3. http://www.nytimes.com/2009/02/17/education/17educ.html
4. http://www.crpe.org/cs/crpe/view/csr_pubs/266
5. http://nces.ed.gov/fastfacts/display.asp?id=1
6. http://www.rsc.org/AboutUs/Campaigns/maintainingstandards/
7. http://www.strangematterexhibit.com
8. Renner, C. *Nature Mater.* **8,** 245–247 (2009).