



The importance of subject specialists in science teaching

Response to the House of Lords Select Committee on Science & Technology's call for evidence on science teaching in schools

1. The Campaign for Science & Engineering is pleased to submit this response to this inquiry into science teaching in schools. CaSE is a voluntary organisation campaigning for the health of science and technology throughout UK society, and is supported by over 1,500 individual members, and some 70 institutional members, including universities, learned societies, venture capitalists, financiers, industrial companies and publishers. The views of the membership are represented by an elected Executive Committee.

The current situation

2. The relatively low number of specialist science teachers in the UK education system remains the single most important factor in need of improvement. Although the total number of acceptances into science teacher training has grown in recent years, the picture is not universally healthy. For example, between 2002 and 2004 (the latest year for which full figures are available), the number of people accepted to train as biology teachers fell by 3%¹. Moreover, the existing shortage will not be rapidly filled by modest increases in supply.

3. The worst situation is clearly in the physical sciences and mathematics. In mathematics alone, the country is short of about 3,400 teachers, which means that even if 40% of all British mathematics graduates were to become teachers for each of the next few years, there would still be barely enough to provide a good mathematical education for all pupils². In physics, about a quarter of all state secondary schools do not have any physics specialists³.

4. Partly as a result of this shortage, a high proportion of teachers are required to teach outside their specialisms. Two-thirds of those who teach physics to 15- and 16-year olds do not have a degree in physics, and one third do not even have the equivalent on an A-level⁴. One in ten of the people who teach chemistry to students between the ages of 11 and 18 do not have any qualification in chemistry. Nine per cent of biology teachers have no biology qualification⁵. Only 64% of secondary school lessons in general or combined science are taught by people who claim to have a degree in the subject. 74% of biology lessons, 78% of chemistry lessons and 72% of physics lessons are supposedly taught by people with a relevant degree, but these figures include teachers with general science degrees, not just subject specialists⁶.

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5. The Government's recent commitment that all pupils who attain the Level 6 at Key Stage 3 will be entitled to study three separate science subjects at GCSE level⁷ is admirable in principle, but will be difficult to deliver in practice if the shortage of specialists is not reversed.

6. Data on the retention level of teachers do not appear to be easily available, certainly not broken down by subject. But anecdotal and regional studies paint a picture of a continuing problem. For example, in Northern Ireland, the Department for Education was reported earlier this year as saying that 70% of teachers were retiring early and that this figure had increased rapidly from previous years⁸.

Attracting science teachers

7. While existing incentives are welcome, they clearly do not address the underlying perception among many graduates that teaching is an unattractive career, especially in the sciences where unemployment is low and skills are highly valued elsewhere.

8. If the Government is serious about attracting into teaching the numbers of physics and chemistry graduates needed to fill the current shortage, it will need to take account of the market for these people. A recent study showed that people who have a degree in these subjects have a very substantially increased average earning power⁹, and with other factors (such as the esteem in which teachers are held) apparently less conducive than in the past to attracting graduates into the profession, more will need to be done.

9. Strong research evidence links earnings potential with decisions about a career in teaching¹⁰. To compete for good quality graduates, the teaching profession will ultimately need more than the relative modest 'Golden Hellos' currently on offer.

Teaching science

10. In our consultations with teachers, CaSE has heard strong criticism of the lack of professional development based around subject content. Science moves forward quickly, and teachers need to feel engaged with developments in their fields. At the moment, most existing professional support appears to be about generic teaching issues (which may be important in themselves), but not to address the more specialized needs of science teachers.

11. Primary school teachers have reported to CaSE that they would appreciate the support of peripatetic science specialists coming into their schools. Most primary school teachers are not trained as scientists and lack the confidence to teach science. Indeed, several secondary school teachers have reported to CaSE that they have had to unpick misunderstandings given to children in primary science lessons. Since a good grounding at the primary schools stage could be hugely important to children, more support for their teachers (perhaps along the lines of the literacy and numeracy strategies) could prove useful.

12. In CaSE's opinion, changes to the curriculum are not crucial in regard to the recruitment of teachers. Good teachers will make any curriculum inspiring, poor ones will make any curriculum dull.

13. Practical classes are essential in teaching science, which is an inherently practical subject. When CaSE surveyed secondary schools in England¹¹ and in Scotland¹², we found that large percentages were cancelling practical classes for a variety of reasons, the principal two being a lack of equipment, and concerns about the behaviour of individual pupils. Not a single teacher downplayed the importance of practical work; all the interaction CaSE has had with science teachers, with universities and with employers suggests that practical work is considered crucial by all interested parties, and that all sectors are worried at the decline in practical experimentation and field work in school science courses.

Schools

14. One of the most important and under-addressed issues is the insufficient availability of schools laboratory technicians. During a recent meeting in Northern Ireland, for example, teachers told CaSE that it was almost impossible to find trained technicians. In one school a vacant technician's post had eventually been filled by a dinner lady because no suitably qualified person was available.

15. Some schools laboratories have clearly improved in recent years, but there remains a great deal to be done, and last year the Science Minister, Lord Sainsbury described some laboratories as "appallingly out of date". However, an apparent promise during the General Election campaign to provide an extra £750,000 per school for improving laboratories has recently been abandoned¹³.

16. More generally, a good quantitative study is needed of the ability of schools to excel in science teaching. Some schools have seen an increase in the uptake of science subjects over the past few years, against national trends. It would be useful to know what factors within schools might have affected this pattern. It remains unclear whether status as a specialist science school is important or whether the success of these institutions merely correlates with the fact that they have more appropriate levels of funding to provide facilities.

17. Links between schools, universities and industry could usefully take the form of exchange secondments, whereby teachers could take a sabbatical in a laboratory and those working in active science could come into schools for a while (especially graduate students who may want to give teaching a try). This is exactly the sort of subject-specific professional development that would benefit science teachers and which many have told CaSE they would welcome. However, funding does not exist to provide cover for staff who are away from the classroom, and there is in any case such a shortage of science teachers that even if funds were available, it is not clear that, at present, high-quality cover could be guaranteed.

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Notes and References

¹ <http://www.gttr.ac.uk>

² *Making mathematics count*, Stationery Office, 2004

³ *Physics in schools and colleges*, The Gatsby Charitable Foundation, 2005.

⁴ *A study into the professional views and needs of science teachers in primary and secondary schools in England*, Council for Science & Technology, 2000.

⁵ *Secondary schools curriculum and staffing survey*, DfES, 2003.

⁶ *Secondary Schools Curriculum and Staffing Survey*, DfES, 2003.

⁷ *Science and Innovation Investment Framework 2004-1014: Next Steps*, HM Treasury, 2006.

⁸ http://news.bbc.co.uk/1/hi/northern_ireland/4581952.stm

⁹ *The economic benefits of higher education qualifications*, PricewaterhouseCoopers, 2005.

¹⁰ *Recruiting and Retaining Teachers in the UK: An Analysis of Graduate Occupation Choice from the 1960s to the 1990s* by Arnaud Chevalier, Peter Dolton and Steven McIntosh presented at the Royal Economic Society's 2003 Annual Conference at the University of Warwick, 2003.

¹¹ *Survey of Secondary School Science Teachers*, CaSE, 2004.

¹² *Survey of Scottish Secondary School Science*, CaSE, 2004.

¹³ Reported in the *Times Educational Supplement*, 10 March 2006.