THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

LECTURE AND DINNER DISCUSSION SUMMARY SHEET

Science Education - is there a crisis?

Held in the rooms of the Royal Society on 8 March 2000
Sponsored by: The Engineering and Marine Training Authority

In the Chair:
The Rt Hon the Lord Jenkin of Roding

Speakers:
Dam Tamsyn Imison, Headmistress, Hampstead School;
Professor Robin Millar, Department of Education Studies, University of York;
Professor Julia Higgins, CBE FREng FRS, Imperial College.

Dame Tamsyn concluded that there was a crisis, but that it could be managed. She reached that view by considering the means by which educational leaders and teachers could improve an admittedly serious situation, comprising widespread scientific illiteracy amongst the general public, shortage of good science teachers and a reluctance on the part of pupils to pursue scientific subjects. But the latter two points should not be overemphasised. 2400 science graduates a year were coming into teaching and there was a keen interest amongst students for scientific information. More good science teachers could be brought in if schools stopped being arts and humanities biased and valued science; ensured that teacher learning and development were taken seriously; encouraged creativity and cross fertilisation and developed outside partnerships. Schools themselves need to be stronger advocates for science teaching; welcome visitors; and combat staff isolation both by creating teams and developing relations outside the school. Pupils would be encouraged to learn science if teams of teachers could have greater autonomy and allowed creativity. Key Stage 3 should be challenging; the academic/vocational divide should be bridged and full advantage taken of Education 2000. Science teachers themselves must be given the opportunities to and recognise the need to continue to learn; they should work with and learn from other good science teachers; be encouraged to take risks; and develop techniques for involving pupils by encouraging them to play with ideas and discuss scientific issues. Full advantage must be taken of new techniques - encouraging the use of the web for research, and using distance learning to access other teachers.

Professor Millar questioned the use of the word "crisis". There was a long history of worry about science teaching; internationally we were not doing too badly and had more pupils taking GCSE science subjects than before. But there were some very worrying signs - the difficulties of transition from GCSE to A level courses; the view of most pupils that the science they are taught is boring and irrelevant; the decline in the number of graduates wanting to teach science (now at rock bottom); and the lack of enthusiasm they have for the value of their subject, compared with arts graduates. All this reflected a systemic defect in the science curriculum, which failed to motivate the minority who might wish to become scientists, or to give the majority, who would not become scientists, a sufficient understanding of, and interest in, the principles and processes of science to enable them to understand, as citizens, the basis of arguments on scientific issues. Science 2000 proposed a new curriculum based on a core course up to age 16 which would provide a broad understanding of the major scientific ideas - e.g. atomic structure, DNA - and a feeling for how science is done together with optional modules which would form the basis for more advanced study. The teacher training implications of such a curriculum were considerable. It would mean, for example, that teachers would have to be able to take on discussion and argument in subjects which were not their speciality, as well as being able to teach at advanced level in their own subject.

A level scores for entry to HE, while rising in other subjects, were falling in science. The scientific literacy of the public was minimal; and many pupils were turned off science. But there was a government seriously interested in scientific teaching; a national curriculum for science; and 80% were taking a science subject at GCSE. The question of professional development was being tackled and the DfEE paper on "Raising Aspirations" was reviewing the curriculum. But it was important that HE recognised its responsibility to improve the position. Universities needed to review the content of their science courses, the way they selected entrants, and the way they assessed them. There was still a reluctance to see anyone who had done a mixed A level as being a proper scientist; the content of the courses must reflect the knowledge base of the students and the assessment of students should be based on a wider understanding of their abilities and aspirations. Furthermore, universities must reach down into the secondary level to help and motivate students. There was scope for undergraduates and graduate students to go into schools, both to help in the professional development of teachers and to stimulate and motivate pupils.

A major theme in the following discussion was the purpose and content of the science curriculum. It was crucial that the curriculum was so devised that it enabled teachers to make science interesting to tall - not just to those who wanted to become scientists. This involved concentration on the scientific process. There must be a recognition that scientific knowledge evolved; there was no one right answer; different answers appeared as knowledge grew; to suggest otherwise was a "fraudulent prospectus". What put many pupils off was their feeling that they had nothing to contribute; they were merely receptacles into which facts were to be stuffed. This contrasted strongly with the enthusiasm with which many (even special needs pupils) studied history; they felt that there were points they could argue about and contribute to in discussion. A balance, of course, had to be struck; there was no point in allowing pupils to think that it was as acceptable to argue that the world was flat as it was to argue that it was round; nor was it possible to design a curriculum which did not involve a considerable body of fact learning. But the emphasis should be on why certain arguments stood and others fell; what were the salient features of underlying theories; and the interaction of scientific knowledge with ethical and social concerns. At University level too many undergraduates came in as "6th form survivors" - stuffed with knowledge but still needing to learn how to argue and how to learn, rather than simply being taught. It was important that, at the earliest possible time, students should own their knowledge - i.e. feel that they understand the reason why they learnt facts, and the process by which they (or any other) could disprove them.

Further discussion on the curriculum brought almost universal disapproval of Key Stage 3, which involved no more than sitting down and listening. Teaching scientific history was vital - not only was it full of exciting stories which captured the imagination, but it showed how theories thought to be unassailable were eventually shown to be misguided, and facts considered firm were discovered to be errors. The macro element was clearly missing. But it would be a mistake to go for a curriculum which was populist or easy. This would deter good students. The study of scientific theory was not easy; it could be tackled at various levels, according to ability, but at whatever level it was tackled, it was essential to make it clear that there were complexities which could only be unravelled with further study. This would help the student to spot the overconfidence shown by some NGO spokesmen, who thought a superficial grounding enabled them to pontificate on difficult issues.

Another theme of discussion was the low value that society placed on learning, on science and, in particular on science teachers. The contrast between the UK and Far East economies was notable. If it were possible to create greater understanding of the value of science - perhaps the greatest achievement of the human race - and the means - experiment, analysis, imagination, logic - by which it had developed, then the status of learning itself would rise. Science was essential and must be taught; although the enthusiasm of individual teachers and researchers might well have its genesis in a particular discipline, science was now interdisciplinary, and the big subjects of public debate and interest could not be settled within the boundaries of one discipline. Science teachers themselves must be recognised as part of the scientific community and links between industry and schools strengthened - with a recognition that pay should reflect the value that any member of that community contributes to society.

Sir Geoffrey Chipperfield

The discussions were held under the rule that nobody contributing to them may be quoted by name after the event. None of the opinions stated are those of the Foundation for Science and Technology, since, by its constitution, the Foundation is unable to have an opinion.

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