THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

The Association for Science Education

DINNER/DISCUSSION SUMMARY

Redesigning the science curriculum: what does society want?

Held at The Royal Society, 6-9 Carlton House Terrace, London SW1Y 5AG
on Tuesday 20th May 2003

Sponsored by
Pfizer
The Sector Skills Council for Science, Engineering and Manufacturing Technologies (SEMTA)

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

Speakers: **Dr Ken Boston AO**
Chief Executive, Qualifications and Curriculum Authority
Professor John Holman
Science Education Group, University of York
Ms Sue Flanagan
Deputy Headteacher, Forest Gate Community School, Newham and
Chair, Association for Science Education

DR. BOSTON outlined the challenges facing science and technology (S&T) teaching in schools: it needed to provide a sound basis for all pupils to understand the world in which they will live; provide a progression for those who intended to do more science; and provide society with enough people with S&T skills to stimulate the economy. All this in a society which was deeply ambivalent about S&T; and with pupils who did not think it "fun". But there had been great achievements through the National Curriculum: a balanced science course was available to all; the UK was top of the international league table for scientific understanding of 15 year olds. But the great challenge was to inspire pupils to carry on in S&T; to overcome the view that S&T was not "relevant" or "exciting". Better teaching by teachers with in depth knowledge of their subject was a major part of the answer – although there was no way round the fact that science was hard work and its results, which often challenged common sense and easy assumption, hard won. But reforming the National Curriculum so that it reflected the differing interests of pupils – those who wanted to learn more fundamental science and those who wanted to apply science – would greatly help. The value-loaded distinction between vocational and academic courses had to go; and both paths treated as of equal validity. Designing the three new GCSE courses – core, applied and advanced S&T – was the project for "Science in the 21st Century". The QCA (Qualifications and Curriculum Agency) was basing its work on wide consultation with teachers, pupils, universities and employers and others.

PROFESSOR HOLMAN said that the National Curriculum, with its attendant assessments and league tables, was an immensely powerful weapon, dangerous if badly designed or implemented. Science education, only 10 years old, had traditionally been seen as preparation for specialists; there was no consensus about how it should change to accommodate new needs such as public understanding of science and the demand for a "Science and Technology (S&T)" literate workforce. It was essential (as Dr. Boston had said) to involve scientists, educationalists, teachers, the general public and pupils in design. So the Advisory Committee on Science in the 21st Century had consulted very widely. The proposed structure involved three courses – core science; additional science and applied science. Core would be taken by all pupils, who could choose which of the others they would pursue. All courses would cover the range of science subjects with a variety of modules. The core science course would have nine modules which should enable pupils to grapple with the relevance of science (e.g. organic foods, global warming), the nature of big scientific ideas (e.g. chemical equations) and scientific method (e.g. data problems – context and correlation). Modules in additional science would focus on areas such as brain and mind; radiation; chemical change; or electrical currents. The applied course would focus on issues such as life care or scientific detection.

MS FLANAGAN said she wished to give the view from the classroom. She emphasized the need for the National Curriculum to connect with the aspirations of very different pupils, whose abilities and interests grew and developed at different speeds. Flexibility was crucial. Great progress had been made – triple science had been rare before the National Curriculum;

primary schools were now doing science, and our international position was good. But so many pupils were not inspired to carry on learning – S&T was not "fun" relevant etc. Of course better-qualified teachers would help to overcome this antipathy, but they could not succeed unless teachers inspired their pupils. This meant having time it was understood that to explain the importance of science for understanding issues which affected the pupils in their day to day lives; to listen to their views and discuss them; and to introduce them to museums, factories or laboratories where S&T could be seen at work. This meant there would have to be space found in the National Curriculum for such work, with a diminution of content work. Bringing real scientists into contact with pupils was also important. The media image of scientists showed them as oddballs; pupils needed to understand that scientists were, in many ways, just like them but with enthusiasm and drive. Meaningful work experience, which meant differentiation for different skills and abilities, was also important. If the National Curriculum was well designed, it should offer many opportunities for non scientists to pursue and develop S&T interests after 16, but they could well benefit at earlier ages as there were many other subjects, such as history, where problem solving skills, which could make use of scientific methods, were important.

Many speakers, in the course, of the discussion, welcomed the broad approach outlined by the speakers to the new S&T curriculum, but there were many concerns about the practicability of its implementation. For example, would it be possible sufficiently to reduce the factual content of he courses, in order to allow the discussion and problem solving that the speakers had rightly identified as vital? Could the assessments in tests capture this aspect of a pupil's development? Schools were skilled in getting good marks in tests, and tailored their teaching to get them – could this drive be adapted to deal with the new types of learning which the National Curriculum wished to promote, or would they simply study the tests ands ignore the aims of promoting wider interest in S&T? Could a genuine equality of esteem between applied and academic courses ever be achieved? Would not those who took applied courses always be seen by ambitious schools and teachers as "the B team"? How did you mange to bring ethical considerations, which were central to the concerns of many adolescents, into such teaching? Were the modules sufficiently comprehensive to capture the interests of the young; psychology, for example, was one of the most popular university courses; was physiology in the modules. Where was the emphasis on creativity? Others vigorously challenged such fears and doubts. True, assessment was crucial to the success of the new agenda, but there was no reason to assume that tests which related to the modules could not be designed so as to emphasize the importance of the pupil thinking about wider issues in relation to the facts – and, certainly, the ethical considerations would be part of those issues; you could not discuss, for example, GM foods, without bringing in such issues as civil disobedience and support for the third world; "in vivo" biology inevitably brought up the question of experiments on animals. The problem for the teacher was to direct the discussion objectively, and, for the examiner, to test how the pupil had related facts to values, without getting a regurgitation of strongly held opinions. Psychology would feature in the courses – most prominently in any module concerned with brain and mind; but psychology was fundamental to learning how to use scientific method – e.g. about how to use data and not deceive oneself by using only material which favoured one's own views, rather than considering facts objectively. Problem solving would itself provide the fulcrum for creativity.

On a more practical level, there were concerns about the ability of the infrastructure in schools to cope with the pressure of S&T work, which the new curriculum might bring. There was a shortage of technical assistants (who were a special skill and not to be confused with teaching assistants) and the state of many school laboratories was deplorable. Already there had been a decline in practical science being taught, as there was neither time for experimental work, nor, in many cases, suitable laboratory space. Where were the funds needed to rectify this situation?

A number of speakers recalled that it was inspired high quality teaching, which had made them interested in their subjects and determined to follow scientific careers. More such teachers were essential if the Government's aims were to be achieved. But how did you get highly qualified and inspiring teachers into the classroom? What scientific graduate, faced with student debt and the prospect of higher salaries and less demanding work conditions in industry or commerce, would want to teach? What ambitious school leaver would want to study any science at University, other than those courses, which lead to financially rewarding occupations such as dentistry or veterinary work? There was only one answer to this concern – teaching must be made rewarding, not only in financial terms, but also in the satisfaction of awakening the interests of students, and challenging them with ideas and concepts that both teacher and taught saw as relevant and important to the world they live in. A too narrow and restrictive curriculum hindered the sort of teaching, which could produce such rewards. A number of speakers thought that the new National Curriculum proposals would significantly improve the situation.

Sir Geoffrey Chipperfield KCB

The Foundation for Science and Technology
Tel: 020 7321 2220
www.foundation.org.uk