THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

LECTURE AND DINNER DISCUSSION SUMMARY SHEET

Educating young people to think about innovation and design

Held in the rooms of the Royal Society on 29 November 2000
Sponsored by: The Engineering Council, EMTA, Foresight Project – Office of Science and Technology, DTI, SPE Ltd, Thames Water

In the Chair:
Lord Oxburgh KBE FRS, Rector, Imperial College of Science, Technology and Medicine Council Member, Foundation for Science and Technology

Speakers:
Mr David Hargreaves, Chief Executive, Qualifications and Curriculum Authority

Dr Patricia Murphy, Reader in Education, Open University

Dr John Patterson, Member, Materials Foresight Panel

The discussion focussed on the teaching of design and technology in secondary schools. A number of speakers called for strong links between science on the one hand and design and technology on the other, but also drew a distinction between them. Science was explanatory and predictive, while design and technology were aspirational, designed to change the world. Teaching design and technology was all about giving young people a "can do" attitude. Nevertheless the teaching of science could complement that of design and technology. For example, Hooke's law on the behaviour of elastic solids under strain could be applied to making things by bending materials. One speaker regretted that smells and bangs were no longer allowed in the teaching of science and technology. They should be taught experientially, not just from books, and the excitement should be put back in.

Participants in Young Foresight, both from schools and from industry, reported on their experiences. In one area the students benefited from regular visits from stimulating mentors from the electronics industry and had come up with a range of ideas. (One proposal, for example, was for combining several domestic appliances in one in order to save space in small houses and flats designed for the growing population of single-person households.) Continuity was important, and one problem was that the brightest of the young mentors tended to get promoted and move away.

One company which had been developing links with schools had originally envisaged targeting those 14-16 year olds who had not yet opted for science subjects, but this did not work because of time constraints under the national curriculum and also objections on health and safety grounds to bringing children under 16 into factories. Young Foresight was aimed at year 9 - 14-year-olds - specifically so as not to overload the timetable. One speaker reported that it was still difficult to cater for all the options in year 9; against this it was argued that Young Foresight did not entail doing anything over and above what should be happening anyway.

A speaker observed that innovation included enterprise skills. It was to be hoped that Young Foresight would stimulate the growth of new entrepreneurs. In industry things happened largely because of the activities of lawyers, politicians and the public at large, not technologists. One of the aims of Young Foresight was to get young people whose ideas were not yet solidified to think what they wanted from science and address the big picture.

It was suggested that was a problem for the teaching of design and technology, in that GCSE grades were based on individual assessment. Innovation in design and technology resulted from group work and developed the skills of working in teams. One expert view was that this was a soluble problem: knowledge emerging from team working was appropriated by individuals and could be assessed. The issue did, however, need to be addressed specifically. The Government's key skills initiative covered the so-called "soft skills" of problem solving, working in teams and taking responsibility for one's own learning. These were valued by employers, and the challenge was to find ways to measure them. It was suggested that present assessment methods were too paper based, and that there was scope for innovation using information technology. Another speaker observed that in industry such skills had to be assessed all the time.

The training of teachers had to equip them to develop innovation and creativity in their pupils. Teacher training had changed over the years, and student teachers now devoted much more time to working in schools under the guidance of established teachers. This apprenticeship approach worked well for traditional subjects, but in new areas such as design and technology there was some danger of learning bad practice. The colleges of education needed to ensure that student teachers had mentors of high quality. It was important also to recognise individual differences and tailor the training of teachers to their particular strengths and weaknesses.

It was asked whether any particular type of specialist school, of those brought in over the last decade, was especially fitted for developing innovation. In response it was suggested that what mattered was not a particular type of school but the quality of the teaching. The introduction of specialist schools was nevertheless thought to have been beneficial on the whole. They had built high-quality teams of teachers. It might also have been easier for them to make necessary changes in organisation and in the shape of the school day, because there were fewer competing demands to be satisfied. It was also true that specialist schools were relatively well-funded, as a function of the particular activities they pursued, but the funding did not necessarily account for their good results in design and technology.

One speaker felt that the debate took too little account of the pressures on schools. They functioned in a world of league tables and had to aim to achieve good grades for pupils in order to give them passports for the future. The schools had made a lot of progress in developing problem-solving and entrepreneurial skills, but the national curriculum was very full and represented a major constraint.

In response it was acknowledged that there was a problem in providing a sound science base and developing innovation and teamwork within a crowded curriculum. On the other hand cutting down its content was not necessarily a good answer. The approach adopted in the 1960s of "letting a thousand flowers bloom" had not served children well. Part of the answer was to stimulate problem-solving in the teaching of the traditional subjects. A study was cited in which the teaching of mathematics in Japan and the United States had been compared. The American students observed in the study had the rules and procedures for a particular operation explained to them at the outset and then tried them out. By contrast, the Japanese students were set a hard problem and challenged to devise ways to solve it. They ended up being better mathematicians.

Recruiting good physics and maths teachers remained a problem. One speaker recalled being taught before the War by highly qualified scientists and a Senior Wrangler. A career in teaching could still appeal to arts graduates now, but the top graduates in the sciences and mathematics had too many other opportunities. It was suggested that more imaginative teaching of science and technology, with the emphasis on creativity and innovation, could make matters worse by making the science graduates of the future more attractive to employers in industry and commerce. That might nevertheless not be a bad outcome, if it meant that the purse strings came to be held by people who understood science.

Jeff Gill

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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