Physics or Technology?  
Technology or Physics? An experiment in curriculum development

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Abstract
This paper is a case study in curriculum development which links the teaching of Technology and Physics. It aims to show that the majority of physics concepts and knowledge can be taught through a technological problem-solving approach. It is proposed that it would be possible to offer certification in a double award General Certificate of Secondary Education (GCSE) Science and GCSE CDT-Technology.

Introduction
There is much discussion at the present time about what constitutes Technology within the school curriculum. Until recently, Technology was seen as a Certificate of Secondary Education (CSE) or General Certificate of Education (GCE) subject, and this specific subject base has developed into General Certificate of Education (GCSE) Technology or GCSE CDT (Craft, Design and Technology). Most syllabuses are based on physical science concepts within a problem-solving process of design and make. More recently this base has been in question (Ditchfield and Stewart, 1987) as being rather narrow when industrial technology includes both biological and chemical technologies. In 1985 HMI observed (DES, 1985), 'more attention should be given to the development of technological work which reflects the importance of biology and chemistry and which is of intrinsic interest to both boys and girls'.

An Assessment in Performance Unit (APU) study (1987) has tried to identify the discrete stages in the process of Technology. The process is complex, with dynamic interrelationships between generation and development of ideas, investigation and evaluation. They found evidence of the same type of complex interactions within scientific problem solving.

The idea for a new course was to include the concepts and understanding of Physics through a problem-solving approach as part of the Technology process. The basic philosophy behind the course design was later summed up in the following statement (Hicks, 1983):

'Teaching facts is one thing; teaching pupils in such a way that they can apply facts is another, but providing learning opportunities which encourage pupils to use information naturally when handling uncertainty, in a manner which results in capability, is a challenge of a different kind.'
The capability theme has been developed further more recently by Black and Harrison (1985) in their task-action-capability ideas of individual potential.

Since the early 1980s technology in Science and Craft and Design has been a recurrent theme in curriculum development (DES, 1982 and 1985). The HMI study (DES, 1985) observed that:

'Work of the highest quality was observed where the science taught was related to its applications in life generally and where the pupils were helped and encouraged to use their scientific knowledge to solve scientific and technological problems appropriate to their age and ability.'

The only evaluation of the course to be described has been the author’s, based mainly on the motivation, enjoyment and feeling of success expressed by the pupils. Examination results were comparable with those expected for the overall pupil abilities.

**Developing the course**

It all started when faced with a class of thirty CSE Physics pupils. The author could see the irrelevance in content for half the pupils, irrelevance in outcome for the other half and irrelevance in process for all. Some of the pupils were also following a Metalwork course. The process skills were not being developed in either Physics or Metalwork so the idea of combining the courses in Technology developed. This meant the co-ordination of laboratory and workshops, Science and Design teachers and pupil recruitment.

Two option columns were available; Physics in one, Metalwork in the other. The Technology course was developed as a combination of the two ‘slots’ to provide a double subject option. The outcomes would be an understanding and knowledge of relevant concepts in Technology, Physics and Metalwork and certification in Technology and/or Physics and/or Metalwork. The only Technology courses in the south-west were mode 3 schemes so, having looked around, we decided to write our own.

Content within the CSE Science course, followed by all pupils except the top Physics group, was used as a resource. Basic electricity, structural materials, logic circuits and motion, for example, were all included within the core science. Pupils following the Technology course were made aware of the links between the subjects as and when necessary. Core Physics pupils were not allowed to follow the Technology course because of the amount of overlap between the content of the two courses. This did, however, mean that the learning processes in the O level Physics course had to be considered carefully.

Access to workshops and laboratory facilities could not be arranged for all timetabled lessons. A laboratory was, therefore, fitted out with light workshop facilities for use when the workshops were not available. Capital expenditure paid for a workbench and tools necessary for light workshop needs. Pneumatics, structures, mechanisms and electronics equipment were also bought from the same funding. Drawing boards of the plastic variety with integral T-square were bought for ease of use.

Staffing was ‘generous’ as one of the six periods was double-staffed with the Physics teacher (the author) and the Metalwork teacher timetabled at the same time. This allowed for on-the-job INSET in each other’s methods, techniques and problems in implementing the joint course. To prevent too much repetitive teaching of basic skills to individuals, information sheets were produced to be used as a starting point. This left the teacher free to be a resource to be used by pupils as needed in the problem-solving process.