Pupil attitudes to National Curriculum technology

RESEARCH

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Abstract

The Education Reform Act 1988 (HMSO, 1988) introduced for the first time a compulsory National Curriculum into schools in England and Wales. Technology was one subject in this compulsory curriculum; its inclusion was controversial and (for some) unpopular, generating a debate about the subject's nature and educational value. This study reflects upon that debate by:

- reviewing the opinions of educationalists on National Curriculum technology
- reviewing surveys of pupil attitudes to previous school technology courses
- investigating pupil attitudes to the 'new' subject of National Curriculum technology, and
- discussing whether the general aims set out by the subject's creators have been achieved.

Introduction

Traditionally, 'technology' has formed a small part of the curriculum in British schools, being subsumed within "Art and Craft" in the primary sector and being optional in secondary schools. The decision taken in 1988 to include technology as a compulsory element in the National Curriculum for pupils aged 5-16 thus marked a radical departure. This decision was (and still is) controversial. Some commentators argue that the subject is so important that the well-being of our society may depend upon it, whereas others doubt the subject's value. Even proponents of the subject hold widely differing views about its nature. Thus it is hardly surprising that the introduction of National Curriculum technology has not been smooth and that in its relatively short life the subject has undergone considerable change. This disorder has led to a lively debate about the credibility of the subject which has resulted in numerous assertions being made about National Curriculum technology. In this study, some of these statements are compared to the views of a sample of pupils who have studied National Curriculum technology since its introduction, in order to provide an empirical basis for further comment. In addition, the Non-Statutory Guidance for teachers (CCW,1990) set out aims for the new subject; an assessment is made of whether these aims are being achieved in practice.

Survey

The study was carried out in a predominantly English-speaking rural Local Education Authority area (LEA) in Wales. Of the eight secondary schools in the authority, six agreed to participate in the study. A pupil questionnaire was distributed (by appointed form tutors) to 25 boys and 25 girls from each school making a total of 300 pupil participants. Year 12 pupils (1994-5) were chosen because they belonged to the first cohort of pupils to take National Curriculum technology for a full five years. The pupils filled in the questionnaires during contact time with their form teachers. Interviews with 20 pupils were carried out after the results had been analysed in order to clarify some of the issues raised.

The study does have some limitations, the most important being that the sample is relatively small (241 pupils responded), and is taken from a predominantly rural area. It is possible that the pupils' views are atypical, as they may have been affected by problems surrounding the subject's introduction. Some pupils may also have resented the fact that the subject had been made compulsory for the first time.

Literature survey

It is apparent that subjects which have traditionally contained a large element of manual skills have been regarded by many academics as suitable only for the intellectually challenged. In 1985, the Standing Conference on University Entrance (SCUE) advised that pupils who wanted to go to university should avoid "unconventional 'A' levels". Design and technology was one of the subjects stigmatised by this comment (Penfold, 1988). Norman (1985) summed up the situation which followed the SCUE decision, stating that "Technical and vocational subjects, especially those involving a strong element of practical skill, have been virtually outlawed by the universities". Penfold (1988) further pointed out that a number of subjects which were largely taught in a practical way suffered from a low educational status:

> "Almost from the beginning, practical subjects were firmly at the bottom of the academic hierarchy ... clever children have regularly been diverted away from the workshops to academically respectable spheres."

When the National Curriculum Technology Orders were published (HMSO, 1990) there followed a fierce debate about the nature of the subject described by the Orders and the Non-Statutory Guidance (NSG) for teachers (CCW, 1990). Toft (1989) and Mulberg (1992) appear to support both the inclusion of technology as a compulsory element of the curriculum, and some of the characteristics described by the NSG. McCormick et al (1992) supported the notion that technology should be taught "from some basis of an understanding of the world around". Others who appeared broadly in favour of National Curriculum technology include Shaw (1991), Naughton (1992) and Eggleston (1992), whose comment that

> "every citizen needs to be familiar with a wide range of technology in order to have sufficient understanding and capacity to live effectively in modern society"

typifies the views of many of the subject's supporters.

A critical view of National Curriculum technology has been put forward forcefully by a number of authors, many of whom argue that the new 'subject' was created by banding together a disparate group of other subjects previously taught as separate disciplines. As Smithers and Robinson (1992) complain:

> "(National Curriculum technology) embodies the aspirations of different interest groups which have been kept together only by pitching its objectives and content at such a high level of generality that it can include almost anything."

Indeed, Medway (1992) maintains that technology in the National Curriculum is based on a 'discipline' which does not exist at all outside the school:

> "The concept of technology on which the curriculum is based is in fact a normative, not an empirically derived one, an artificial constraint whose links to reality are tenuous and problematic."

Medway goes on to point out that National Curriculum technology provides a combination of activities in the classroom linked to so many diverse occupations that it represents

> "an apparent blindness to the division of labour in society... this extraordinary assemblage (of skills) ... would almost never be exercised by one person"

and the only rationale for bringing them all together is evidently "the belief that they are all design and technology activities". This remark encapsulates his concerns:

> "It is ... important to ask how this new subject got itself invented ... By way of an answer (we find) on the one hand, educational idealism and well-founded theory, and, on the other, conceptual confusion, unrealistic aspirations and ideological loading..." (Medway, 1992)

Others have also noted incongruities in the nature of National Curriculum technology. Barnett (1992) points out that the original subject Orders are divided into "two distinct components – Design and Technology, and Information Technology (IT)". He comments that this separation was "a witless demarcation which the working group (on the proposed curriculum) attempted to challenge but without success". Many technologists see this distinction as a fundamental flaw. The working group actually stated in the Interim Report (1988) that "IT... forms an essential part of D&T because it lies at the heart of many artefacts and systems". Despite this, in the latest version of the subject orders (HMSO,1995) IT is no longer even a part of design and technology.

A few studies on pupils' attitudes to the status of technology as a school subject have been reported in the past. McCarthy (1989) carried out a small-scale study which revealed some positive attitudes to CDT:

technology; however the sample was small, consisting of 40 pupils all of whom had opted for the subject. It is therefore likely that they held the subject in higher esteem than others in the year group. Ormerod and Waller (1988) noted that pupils who chose to do CDT in Year 9 were associated with having a weakness in both mathematics and intelligence by those pupils who did not opt for CDT subjects. As in the McCarthy (1989) study, craft-based and drawing-based CDT options were held in the lowest esteem. An international investigation by Raat and De Vries (1986) discovered that "pupils find it hard to give a description of technology and are unaware of the role of creativity and design in it". Pupils were also found to be ignorant of the types of work done by technologists.

The questionnaire and data analysis

The questionnaire was prepared with the aim of discovering pupil attitudes concerning:

- the status of National Curriculum technology relative to other subjects;
- the usefulness of National Curriculum technology to pupils' career prospects; and
- the degree to which the distinctive features and general educational aims of National Curriculum technology as identified in the Non-Statutory Guidance for teachers (CCW,1990) had been achieved.

The pupils also filled in details concerning:

- their gender, and
- the subjects which they had opted to take in Year 12.

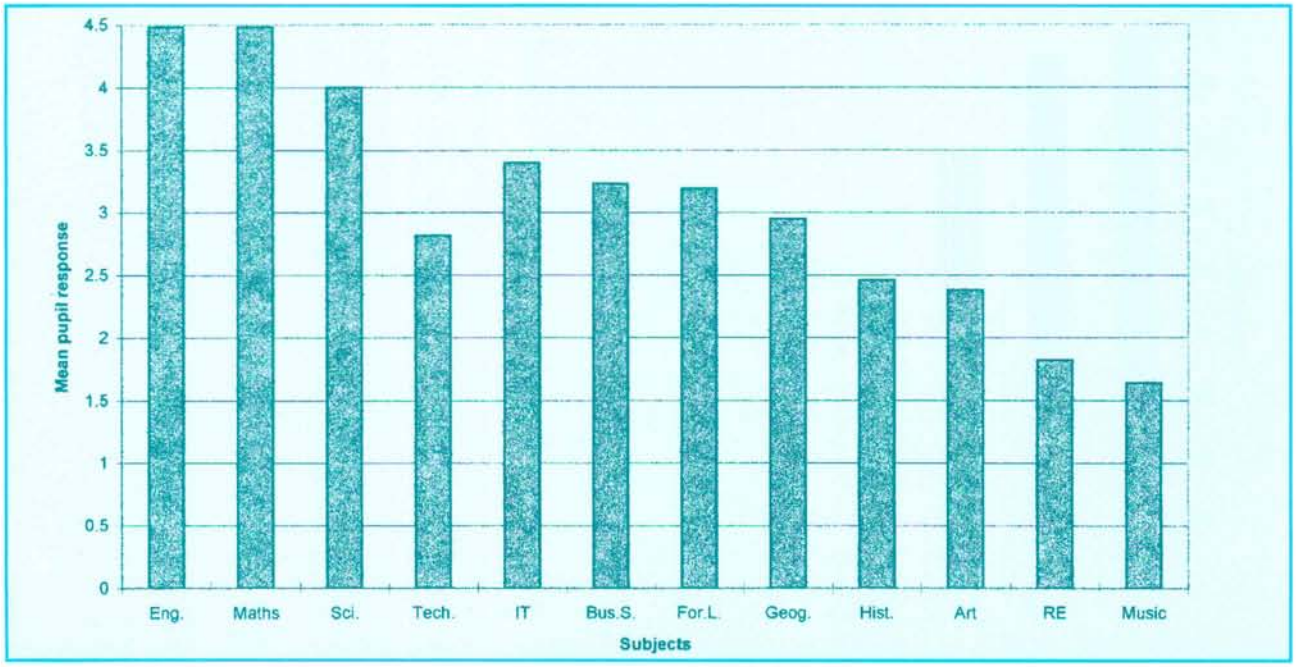
A chi-squared test was applied to establish whether there were any statistically significant response differences between arts and science pupils, and between gender groups.

Results and discussion

Question 1

Pupils were asked to rate the National Curriculum subjects in their order of importance for future career prospects. A five point scale was used, where 5 = Very important, 4 = Quite important, 3 = Average importance, 2 = Less important, 1 = Least important. The weighted mean response was calculated (Figure 1). English (mean 4.48), Maths (4.48) and Science (4.00) were regarded as being the most important for pupils' career prospects. Technology (2.82)

Figure 1: Importance of each subject for pupils' career prospects (weighted mean)



was ranked eighth out of the twelve subjects and thus was rated as being of below average importance.

Science pupils apparently considered technology to be more useful to their career prospects than arts pupils. Science pupils placed technology in sixth position, whereas arts pupils placed technology eighth. This lends support to the view that technology is perceived as having more in common with science disciplines rather than arts. However, even science pupils gave technology a low rating compared to English (4.06), Maths (4.4), Science (4.57), and Information technology (3.49). Male pupils ranked technology seventh (mean 3.00) and female pupils placed the subject eighth (2.63)

Question 2

Pupils were asked to choose the four National Curriculum subjects which they would study, if only four subjects could be studied. The results are shown in Figure 2. English (87.1%), Maths (84.2%) and Science (68.5%) received significantly higher scores than the other subjects. Technology gained only seventh place (17.8%).

This seems to show that many pupils do not consider that technology is sufficiently important to be a compulsory subject at Key Stage 4. The status of technology is clearly much lower than that of English, Maths and Science, and considerably lower than that of a Foreign Language.

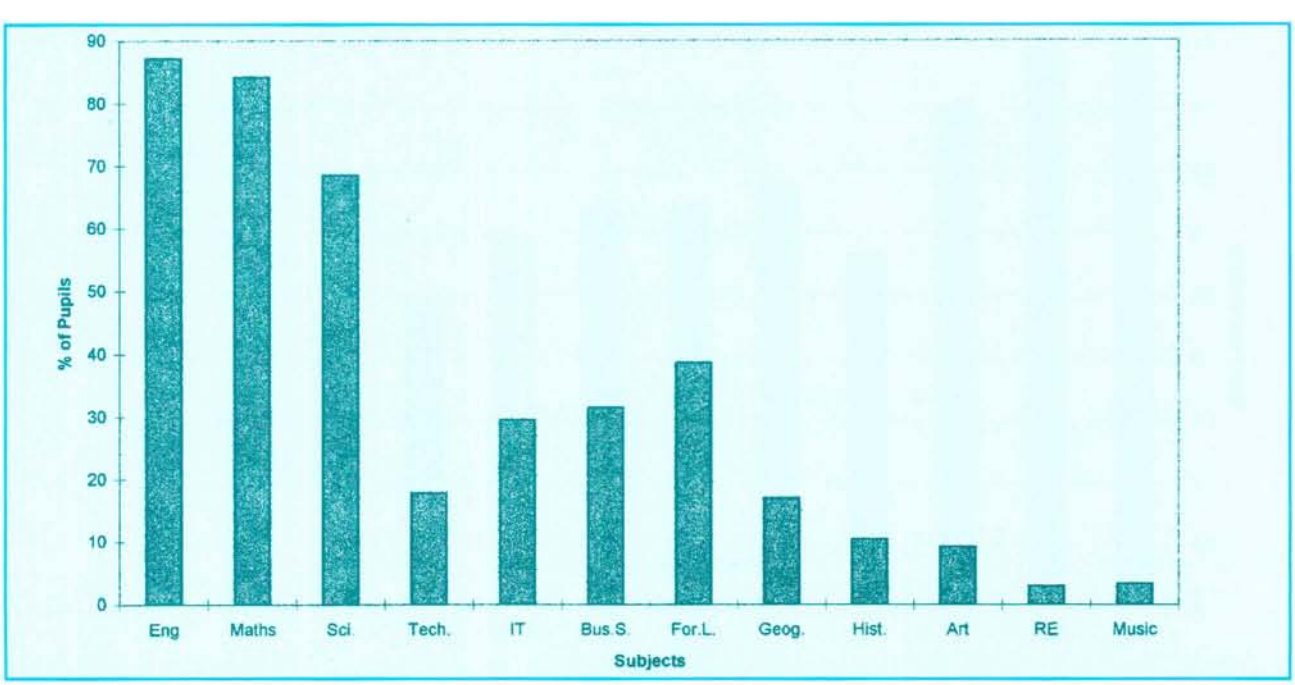
A comparison between arts and science pupils established that science pupils gave technology a much higher score than arts pupils (science 29.5%; arts 13.9%); however, science pupils still considered that information technology (fourth place) and a foreign language (fifth place) were more important than technology, and placed business studies in equal sixth place with technology.

Arts pupils placed technology in eighth place, well behind a foreign language (fourth), and information technology (fifth). This is further evidence that arts pupils appear to hold technology in lower esteem than science pupils.

Male pupils placed technology seventh (24.2%), whereas females placed the subject ninth with a much lower score (11.1%).

This evidence suggests that pupils accept that English, maths and science should be compulsory subjects at Key Stage 4, but they feel that the fourth subject (assuming that there should be four) should not be technology. The most important inference to be drawn is that many pupils are studying technology who would not do so if they had a choice.

Figure 2: % of pupils who would have chosen each subject as one of four compulsory subjects at KS4



Question 3

Out of all your GCSE subjects, are there any that you now wish you had not studied? If so, name them on the line below, and give a brief explanation.

Of the 117 pupils who responded to this question, 42 (17.5% of the sample) stated that technology was a subject that they wished they had not taken. The next highest response was for history (15 pupils - 6.2%) and the remaining subjects had scores lower than eight (3%). The reasons that pupils gave for wishing that they had not been obliged to take technology fell into three categories:

- those who felt that it did not "give them the skills that they would need in later life" (7 pupils);
- those who stated that it was "a waste of time that could have been spent on more important subjects" (27 pupils);
- those who stated that there "is nothing technological about the subject" (8 pupils).

Thus the number of pupils who regretted taking technology was much higher than for any other subject. This may have been due to the fact that for the first time technology was compulsory, though the compulsory core subjects (English, Maths, Science) did not receive any such responses. It is a cause for concern that 27 pupils (11.2%) resented the fact that the time given to technology prevented them from taking what they regarded as "more important subjects". On the other hand, 199 pupils (82.5%) did not indicate any regret at taking the subject.

Question 4

Pupils were invited to agree or disagree with a number of statements (see table 1).

These statements were based upon descriptions of the aims and nature of National Curriculum technology found in the NSG for teachers (CCW, 1990). The question was therefore designed to asses how successfully National Curriculum technology had fostered in the pupils the attitudes, qualities and skills which are, according to the NSG document, vital to a pupil's general education and inherent in the distinctive nature of National Curriculum technology.

Pupils were required to read the statements and respond "yes", "no", or "don't know". The totals were then tallied for each statement.

The results were as follows: (see Table 1).

It is encouraging that for all except one of the statements, a majority of those expressing an opinion gave a positive view of National Curriculum technology; however, when the "don't know" responses are taken into account, two other statements failed to be supported by the majority. It must be a cause for concern that the one statement rejected was that "School technology prepares pupils for work and life in society", and that less than 50% of the pupils agreed either that "School technology helps to prepare young people to live effectively and creatively in a 'technological world'" , or that "School technology fosters an ability to evaluate the purposes, processes and products of technological activity and the wider role of technology in society". These results show that the aims set out for National Curriculum technology are not being achieved for a significant proportion of pupils. It also seems that pupils are not being exposed to the "wide range of technology (that would enable pupils to) have sufficient understanding and capacity to live effectively in modern society" (Eggleston, 1992). One pupil commented that

> "the work done in technology lessons is totally unique and isolated from that done in the outside world. I do not believe that the subject has helped prepare me for life after school..."

These results appear to support Medway's (1992) contention that National Curriculum technology's link to the real world of work is tenuous. Medway also maintains that National Curriculum technology does not allow for the way in which technology often consists of the application of skills to deal

with unexpected situations. Others, for example Smithers and Robinson (1990), claim that National Curriculum technology has no real identity because it embodies the aspirations of too many disparate interest groups (viz. CDT, home economics, textiles, art, design) and thus has to aim its objectives and content so generally that it can include almost anything.

The relationship between National Curriculum technology and the world outside the school gates is also considered by the proposition that: "School technology provides an opportunity for pupils to study technology in the wider world and its interactions with society and the environment". In this case, 50.6% answered 'yes' and 29.5% answered 'no', thus National Curriculum technology seems to be failing (for a significant minority) to achieve another of its fundamental aims. A response typical of those who disagreed with the proposition was that:

> "technology lessons are too contrived – all about the design process and folder work. The subject failed to deal with the impact that technology has on our lives or the environment."

Barnett (1992) identified this as a fundamental problem, pointing out that many basic technological activities such as nuclear energy and road building are not even touched upon because they do not have a design and make element. It is therefore very difficult for those who teach the subject to achieve this aim . If the subject were to be taught in future in a more holistic and anthropocentric way – as suggested, amongst others, by Capel (1992)

Table 1: Pupil responses to the statements in Question 4 a-h, expressed as a percentage of the total (Number of pupils in sample: 241)

Statement	Yes	No	Don't know
a) School Technology helps to prepare young people to live effectively and creatively in a "technological world"	47.7	36.9	15.4
b) School Technology provides many and varied opportunities for pupils to gain first hand experience of the processes which are central to technological activity.	50.6	27.4	19.9
c) School Technology provides an opportunity for pupils to study technology in the wider world and its interactions with society and the environment.	50.6	29.5	19.9
d) School Technology provides an opportunity for pupils to bring together and apply knowledge and skills gained in other subjects.	59.8	27.6	12.4
e) School Technology helps to develop pupils' practical ability to think and act imaginatively, by allowing them to apply their physical and intellectual knowledge and skills.	68.9	18.7	12.4
f) School Technology fosters confidence to solve problems, perseverance in the face of problems, enterprise, good judgement, responsible attitudes to the environment and safety problems.	56	25.3	18.7
g) School Technology fosters an ability to evaluate the purposes, processes and products of technological activity and the wider role of technology in society.	47.7	29.9	22.4
h) School Technology prepares pupils for work and life in society.	36.5	44.4	19.1

– it might be easier to link the subject to environmental concerns.

Although a large number of pupils appear sceptical about technology's potential value to them in their future careers, and its relevance to the world at large, many are more positive about other aspects of the subject. Almost 70% agreed that "School technology helps to develop pupils' practical ability to think and act imaginatively, by allowing them to apply their physical and intellectual knowledge and skills". As one pupil said:

> "Technology is the only subject I did for GCSE where I had to design and make something using my own initiative to solve a problem that I had identified. In the other subjects everybody did similar work involving mainly writing with little opportunity to use our own ideas."

This supports the view that technology is one of the few subjects on the curriculum that gives pupils the opportunity to apply their intellectual knowledge in a practical way, and so

> "makes an important contribution to the creation and maintenance of a proper balance between the acquisition of knowledge and skills and its practical application to realistic and relevant tasks." (CCW, 1990)

Eggleston (1992) maintains that this unique contribution of design and technology to a pupil's educational experience is enough to merit its inclusion in any balanced curriculum. A healthy majority of pupils (nearly 60%) also supported the contention that: "School Technology provides an opportunity for pupils to bring together and apply knowledge and skills gained in other subjects". A typical comment was that

> "Technology is one subject that I enjoyed because I was able to apply many of the skills that I had learnt in other subjects like maths and science, to help solve the design problems."

Technology has therefore been more successful in achieving this aim, and the pupils' responses show that the subject at least partially reflects Naughton's (1992) description of technology as being "the application of scientific and other knowledge".

The proposition that: "School technology fosters confidence to solve problems, perseverance in the face of problems, enterprise, good judgement, responsible attitudes to the environment and safety matters" was supported by 56% of the sample; the 'no' response was 25.3%. Although the aim is being achieved for a majority, a significant number of pupils feel that technology is failing to cultivate the positive personal qualities and attitudes expected. A number of pupils commented during interviews that there was nothing "unexpected" about the problems they had to solve, providing some support for Medway's (1992) suggestion that National Curriculum technology does not deal with the skills needed to tackle unexpected situations, because it is too rationalistic and governed entirely by a systematic design process.

For all the statements in question 4, the responses of groups of pupils (arts and science; male and female) were compared statistically using the chi-squared test. As the sample size was relatively small (241 pupils), only one set of responses showed a statistically significant difference between two groups – though it may well be that other differences which occurred could be confirmed on the basis of a larger sample. The proposition that: "School technology provides many and varied opportunities for pupils to gain first hand experience of the processes which are central to technological activity" gave a "yes" response of 50.6% and a "no" of 27.4%; however, a comparison between arts and science pupils revealed that the higher "yes" response by arts pupils was significant at the 0.05 level. This may reflect that arts and science pupils have different views about the processes which are central to technological activity. Science pupils may have higher expectations and a more refined view of the nature of technology; if this is so, they might have preferred a technology course similar to that proposed by Smithers and Robinson (1990),

who argued that the subject should to cover areas such as: materials, electronics, instrumentation, fluids, structures, and teach skills including: control, measurement assembly, construction and project management. Barnett (1992) is another author who complains that much of the work carried out as National Curriculum technology is "distinctly low-tec ... and the new technologies may as well not exist". As one pupil commented:

> "technology lessons were disappointing as they only involved carpentry and simple metal working with some use of plastic. The new manufacturing technologies and their application in industry were not looked at."

This could well account for the high proportion of science pupils who responded negatively. Indeed, since 76.7% of the sample who take 'A' level design and technology combine it with arts subjects, arts pupils appear more likely to identify the less scientific techniques and processes currently being taught in National Curriculum technology as being technological, and to be satisfied that these techniques will prove useful to them.

Conclusions

From the debate about the nature of school technology, it can be seen that there are a number of conflicting views about the form that the subject should take. The Proposals for technology (Department for Education/ Welsh Office,1992) recognised these difficulties, and noted that one fundamental problem which had to be overcome was that:

> "overall, there was considerable variation in respondents' views on the nature of D&T and what it should contain."

It is very likely that these differing views arose primarily from the grouping together of subject areas which had previously been taught separately, as Smithers and Robinson (1992) and Medway (1992) had pointed out.

The authors of the 'new' subject had hoped to create a high status subject which would overcome previous predjudice whereby technological activities were seen as being suitable for pupils with manual skills but weak intellects. Judging by the responses of the pupils in this survey, this laudable ambition has not been achieved. The status of the 'new' subject remains low when compared to many other National Curriculum subjects, and the hiving off of IT has not helped the cause of technology. The results give weight to Barnett's (1992) view that this separation constituted "a witless demarcation". It is probable that a subject containing IT as an integral part within technology would command a higher status than either subject on its own.

It also appears that science pupils hold technology in higher esteem than arts pupils, and yet 76.7% of the pupils in the survey who take 'A' level technology combined it with arts subjects. Arts pupils feel that technology enables them to experience the "processes that are central to technological activity" (NSG, 1990) to a much greater extent than science pupils; it therefore appears that arts and science pupils have a different view of the nature of technological activity. A survey on a larger sample of pupils could help to clarify these apparently contradictory results.

A large number of pupils do not consider that technology prepares pupils for life in a "technological world", apparently because they believe that the subject does not expose them to the wide range of technology necessary to achieve this. Fewer than 50% of the sample believed that technology is able to foster an "ability to evaluate the purposes and processes of technological activity and the wider role of technology in society". It is therefore clear that the subject as constituted and taught at the time of the survey is failing to place technology in its proper context, which in turn undermines its importance in the eyes of the pupils.

On a more positive note, almost 60% of pupils considered that technology did provide "an opportunity for pupils to bring together and apply knowledge and skills gained in other subjects", and 56% of pupils felt that the subject had improved their

"skills in problem solving, enterprise, judgement and the cultivation of responsible attitudes to the environment and safety matters". In these areas the subject has been fairly successful. The area in which the subject is considered to be the most successful (by almost 70% of pupils) is the capability of technology to "develop pupils' practical ability to think and act imaginatively, by allowing them to apply their physical and intellectual knowledge and skills" (CCW, 1990).

The overall conclusion to be drawn is that if technology is to become "institutionalized ... as a core component of school learning" (Toft 1989) then research must be carried out in order to establish how the subject can be more successful in achieving its authors' aims, perhaps especially that of "preparing pupils for work and life in society" (CCW, 1990). Some of the main questions that need to be investigated arise from claims made by educationalists that many of the difficulties are attributable to fundamental flaws inherent in the nature of National Curriculum technology. Other factors also need to be examined, including the one identified by HMI which links the failure of National Curriculum technology to the "poor understanding of the statutory requirements" by many teachers (HMI, 1992).

The considerable doubt about the rationale behind National Curriculum technology thus appears to be well founded. It is hardly surprising that only a few years after the Orders came into being, the subject which had been heralded as the "jewel in the crown" of the National Curriculum by Duncan Graham (then Chief Executive of the National Curriculum Council) had – according to many commentators – fallen from grace. It remains to be seen whether the post-Dearing version of National Curriculum technology can improve matters – though the separation of IT from technology is hardly likely to be helpful.

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