Technology and Design at Key Stage 3: Perceptions of challenge

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Abstract

The Educational Reform (Northern Ireland) Order (1989) created Technology and Design as a new and compulsory component of the curriculum for all pupils at Key Stage 3. This research investigates the range of challenge that the teachers of Technology and Design perceive to exist for them as they seek to deliver this subject.

A questionnaire was constructed and forwarded to *all* teachers (578) of Technology and Design in Northern Ireland and analysis of the 220 responses received revealed a number of significant factors. These factors were further explored using semi-structured interviews with 24 teachers.

Three main issues are identified and discussed. Firstly, issues related to the Management of Technology and Design and its implementation in the classroom are considered. The challenges presented here relate to the management of teaching and learning within the subject; for example project work, health and safety, resources and staff support, both technical and financial. Other challenges focus upon class size, subject time allocation, recruitment and subject groupings, assessment and generally 'keeping things on track'. The second group of challenges relates to Development within Technology and Design and these are focussed upon the evolving nature of the subject and the need to keep up-to-date with the ever-changing subject content. Finally the actual teaching of the subject and some of the challenges involved are considered. Technology and Design is perceived to be an important and indeed a very valuable subject but it presents many challenges to the teachers involved.

Key words

education reform, challenge, subject implementation, professional development, technology and design

Introduction

The Education Reform Act (1988), ERA, put in place a National Curriculum for England and Wales and Design and Technology, as a subject, formed a central part of that provision (DES/WO, 1989). Following the introduction of the ERA, the Education Reform (NI) Order (1989), ERO, was established (DENI, 1988).

In many respects the ERO reflected the structure and nature of the ERA. The Northern Ireland Curriculum which followed was constructed on the basis of five Areas of Study one of which was Science and Technology. Within this Area of Study a 'new' and 'compulsory' subject entitled Technology and Design (T&D) was introduced and in 1991 a Ministerial Working Group was set up to produce proposals for a Programme of Study. This paper reports on the challenges presented by T&D, as perceived by the teachers who teach it.

Literature

Definitions do not always help understanding but are sometimes necessary to clarify the meaning of words, especially those used in different contexts (Lawton, 1993). The term technology is not well defined nor its scope delineated and thus proves problematic (Barnett, 1994; Black & Harrison, 1995; Evans, 1998; Yeomans, 1998; Barlex, 2000; Owen-Jackson, 2002). As indicated by McCormick "the nature of technology is not easy to pin down, and the definitions that exist do not give us much guidance as to what activities it includes" (1990:45). According to Medway "the term technology itself is unhelpfully fluid" (1989:3), whilst Gardner (1994, 1995) suggests the determination of a definition for the word 'technology' is complicated by the many variations that exist in the English language to explain it. Indeed, Hansen and Froelich (1994) argue that the German word 'Technik' provides a better understanding, an idea highlighted by others (Ropohl, 1997; Norman, 1998).

Lacking consensus, the term technology creates problems for curriculum designers and presents challenges for teachers of the subject. Jarvis and Rennie suggest that because "teachers hold a variety of concepts of technology" (1998:262) the process of introducing technology into the curriculum has been fraught with difficulties. Smithers and Robinson (1992) report that the establishment of technology in the National Curriculum has not been straightforward and as a consequence presents many challenges (Hansen & Froelich, 1994; Gardner, 1994, 1995). In addition, difficulties result from confusion about the delineation of the subject content and the pedagogical methods used to deliver it in the classroom (Wilson & Harris, 2003). According to

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OFSTED (1993:30 Para 64) the "lack of a clear identification of subject content, and its characteristic knowledge and skills, is leading to low-level work", a view supported by Kimbell et al. (1996). Although described as a 'new' subject, Kimbell (2003:3) argues that "Design and Technology has been formed from the progressive amalgamation of many different former subjects in the curriculum". Undoubtedly the same is true of T&D in the Northern Ireland Curriculum.

Over the years, different subjects within the curriculum have undergone change in terms of the teaching strategies employed and the content addressed. However, few subjects have experienced the changes that technology has embraced (Saunders & Warburton, 1997; Martin, 1998). Such changes, according to Fullan and Siegelbauer (1991), can be difficult, less welcomed and indeed, on occasions, even impeded if attempts are made to alter something with traditional value, or if instigated by outsiders (Eggleston, 1993; Wilson & Harris, 2003). Furthermore since the introduction of Design and Technology there has never been a period of stability (Benson, 2003) because, according to Davies (2003), it is a subject under constant review; in Northern Ireland, this is no less the case.

For long-serving teachers changes in practice from CDT to Design and Technology have been particularly difficult (Eggleston, 1993) because of conflicting interests between the two dominant philosophies, the craft-based and the design-and-make approach (Saunders & Warburton, 1997). Moreover new curricular guidelines can be interpreted in different ways by teachers influenced by the specific beliefs they hold (Donnelly, 1992). For example teachers with a science background appear to have a different understanding of the subject from those with a traditional CDT viewpoint. The compulsory introduction of technology into the curriculum, according to Rennie and Jarvis (1995), has left teachers, in particular those more established members, feeling perplexed by the pace, nature and volume of change. Furthermore this situation has been made worse by the large volume of new material that has been introduced (Rennie & Jarvis, ibid). Again comparing technology to mathematics, Saunders and Warburton (1997) suggest that the difficulty with mathematics is not what to teach but

when and how to teach it whereas with technology this is not the case. For some teachers such changes have produced negative feelings about the subject.

Another challenge that creates difficulty, for both teacher and pupil, according to Kimbell et al. (1996), concerns subject assessment and in particular that related to design. It has been suggested (Donnelly, 1992; Kimbell, 1995, 1997, 2003; Kimbell et al., 1996; Davies, 2003) that such difficulties have been increased by the need to satisfy particular assessment requirements, the problem being that it is relatively easy to assess the final outcome of a technological activity but inherently more difficult to assess the processes involved (Stein et al., 2000; Davies, 2003). Finally changes to the management of project work have had a major impact the T&D classroom, creating challenges for many teachers (Barlex, 1998).

Methodology

Guba and Lincoln (1994) describe a paradigm as a set of basic beliefs that guide the research action and the questions asked, the methodology employed and the methods used. This research is addressed within a post-positivist paradigm, which according to Denzin and Lincoln (1994) is a mixed methodology approach; it is used because no single method is capable of establishing a complete picture of what is taking place (McFee, 1992; Cohen et al., 2000). Post-positivism demands the use of qualitative and quantitative methods in a supportive manner, thereby adding rigour, breadth and depth. Consequently two distinct but, inter-related research methods were employed; a questionnaire survey and a series of semi-structured interviews with individual teachers.

A questionnaire was posted out to all Key Stage 3 (KS3) T&D teachers across Northern Ireland (NI) (64 females and 514 males). The involvement of the whole population provided an increased opportunity to gain a better understanding of the emerging issues from both new and experienced teachers. Furthermore the views of all T&D teachers were sought irrespective of their geographical location. The questionnaire was constructed using two question formats, a series of Likert statements and a number of open-response questions. A four-point Likert scale was employed, not uncommon in research of this type (Lavelle & Rickord, 1997; Godfrey, 2001).

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A number of semi-structured interviews were conducted to explore the issues that emerged from the questionnaire analysis. Creswell (1994) reports this as a process of sequential triangulation where the researcher carries out the work in two phases, the results of phase one being central to the planning of phase two. Such interviews allowed general areas of interest to be explored, specific issues to be expanded and a detailed understanding to be gained. Based on the 220 completed responses an interview sample of 10% (22) was considered appropriate given the nature of the work involved and the time and resources available. A final interview sample was set at 24 teachers, with each interview recorded and fully transcribed.

Findings and Discussion

Analysis of the data revealed that T&D within the Northern Ireland Curriculum at KS3 was, according to the teachers involved, a significant challenge. All teachers are conscious of the many changes taking place in education and the resulting challenges, many arising from Education Reform. For the teacher of T&D, changes have included new subject content, ways of working, equipment and teaching resources and the move from old to new teaching environments. One teacher reported; "I think the whole thing is challenging" (Interview transcription).

Within this paper, issues related to 'challenge' are grouped under three headings. The first deals with the management of T&D, the second with professional development within T&D, and the third with the challenges involved in teaching T&D.

Management of Technology and Design

Challenges result from delivering T&D as a part of the Northern Ireland Curriculum and some of these relate to the management of teaching and learning within the subject; for example project work, health and safety, resources and staff support. Other issues focus upon class size, subject time allocation, recruitment and subject groupings, assessment and generally 'keeping things on track', although it is entirely possible that many of these may well have occurred even if the subject had not changed.

Project work

The majority of teachers considered T&D project work to be a challenge. Three-quarters (75.8%) of them suggested that T&D project work was difficult to deal with, whilst 56.1% thought it was a 'hassle' for teachers. Difficulties were attributed to teacher time limitations and to the nature and standard of the work required. The Programme of Study refers to the design and manufacture of products implying something that is complete and marketable. This, according to the teachers, is difficult if pupil skill level is low; a similar view is expressed by Paechter (1995). One teacher commented "I suppose to be successful, they want to have their work presentable and it's difficult with the level of skill which they have in making it presentable" (Interview transcription).

The development of 'skills' in this context was considered to be the competent use of tools and equipment. It was considered that pupils, in some cases, were being asked to carry out tasks that they did not have the necessary skill to do. This and the associated inability to complete set work to an appropriate standard, led to frustration for the pupils and challenges for teachers. Mittell and Penny (1997) argue that students are expected to acquire specific craft skills and failure to do so creates significant difficulties for them. The teachers in this study suggested that the nature and type of tools and machines used presented challenges to the pupils leading to poor quality work and frustration; this equipment generally designed for use by adults. It was reported that, girls in particular were sometimes frightened by the noise of the machines.

Consistent with previous research (e.g. Medway, 1989), teachers believe pupils derive pleasure from their involvement in practical work but are less enthusiastic about the theoretical aspects of T&D.

Health and safety

Just over half (57.9%) argued that health and safety issues such as the need to ensure a safe working environment for all, made T&D difficult to teach and created anxiety for teachers. It was even suggested that health and safety challenges had the potential to spoil the subject for teachers and pupils. Whilst factors such as the school management policy in relation to class affect health and safety, the actions of teachers and pupils can also impact on the enjoyment of the subject.

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Support (technical and financial)
It was suggested that problems also emanated from the lack of support provided by schools for the subject. For example, some report a lack of financial support for the employment of technical support. In reducing staff numbers, a greater burden of responsibility is placed on the teaching staff. Similar to Mitchell and Penny (1997), the results indicate that support is described in terms of technical and financial support. An annotated comment from a teacher indicates that "without a technician a lot of non-teaching periods and time after school is spent preparing materials". (Questionnaire: open-response section)

Reportedly most schools had been quite well catered for in terms of capital funding, but their annual budgets were insufficient, especially when consumables were accounted for. The following exemplar captures the views of most. "Now a much more 'expensive' subject, T&D at KS 3 will only work if subject is resourced – the consequences of inadequate resources are very difficult to deal with". (Questionnaire: open-response section)

References were noted between schools, with teachers in the non-grammar sector experiencing greater funding difficulties than their grammar school peers. In most cases teachers believe their senior managers recognised T&D is an expensive subject; but are not convinced that they fully understood the true costs involved. Support for this view comes from Martin (1998) who found the issue of funding was of central concern and in particular for a new subject.

Class sizes
Class sizes create challenges for teachers in relation to the management of T&D. In their attempts to maximise budget usage school managers aim to keep classes as large as possible but some teachers suggested this led to potential conflict between them and their managers. Class size restrictions are in place to accommodate the nature of the tasks being undertaken and to ensure the safety of all. In addition teachers of T&D favoured the provision of smaller classes because more time could then be given to individual pupils, an important issue given the nature of work involved. Furthermore small classes also increase pupil access to machines and other specialised equipment. Large classes create extra work

and pressure for the teacher in the manufacturing environment. However the teachers recognised that the smaller the class created for T&D, the proportionally more expensive it was for the subject to operate.

Time allocation
Teachers suggested that the time allocated to this new subject created further challenges and two specific issues were highlighted; the allocation of curricular time for pupils within the subject and; the allocation of preparation time for teachers. A majority of the teachers (66.2%) did not agree that T&D at KS3 was too demanding of curricular time. However the expressed view was that the subject was too demanding for the limited amount of time made available for it. Stein et al. (2000) suggest that teachers had difficulty in identifying the true value of technology for their students given the time they had to spend on it. Teachers argued that more time was necessary to ensure that the demands of the Programme of Study could be met. The teachers perceived that the introduction of the NI Curriculum had created time pressures for all subjects and T&D was no exception. The majority of T&D teachers suggested that the time allocated to the subject indicated something of its perceived value. Teachers considered the provision of appropriate time to be central to the success of this potentially valuable educational initiative. Interestingly such comments were independent of the school sector or the gender of the school population involved. Furthermore the teachers, whilst expressing a desire to have increased curricular time for T&D, were realistic enough to understand that if the time allocation for T&D was to increase then there had to be a corresponding decrease in the time available for other subjects; there is a difficulty in satisfying the wishes of all.

A significant minority of the teachers from the non-grammar sector highlighted other matters associated with the apparent lack of curricular time, for example coping with the large spread of pupil ability present within their classes and the difficulty in dealing with weak pupils, although this concern is not unique to T&D. By comparison, few grammar school teachers reported such issues, suggesting that the pupils who attended grammar schools were more able to deal with the subject matter involved.

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Finally, in addition to teaching time, time is also needed by the teacher to prepare his/her work. The teachers commented on the time that they considered it necessary to spend on planning for the effective implementation of T&D in the classroom.

Recruitment of students and subject groupings at Key Stage 4

The difficulties associated with the recruitment of students at the end of KS3 were highlighted as another challenge. Respondents, primarily those from the non-grammar sector, reported some difficulty in recruiting students to study the subject at GCSE in comparison to its predecessor of CDT. It was suggested that schools need to consider the subject groupings offered as these can influence the attractiveness of the subject at later stages. If T&D is grouped with science, then potentially more able pupils may opt for science because of its perceived importance whereas if it is grouped with art it may exclude those who have capability in that direction. If grouped with business studies then potentially it may have lesser appeal to those with an interest in that area and in particular girls who reportedly view business studies as an important subject. This concurs with the views of McCarthy and Moss (1994) who suggest that the way in which GCSE options are timetabled can be an important factor that influences subject choices. Furthermore the comment was made that the decision to make T&D a non-compulsory subject at Key Stage 4 had been a mistake.

Interestingly, it was suggested that, the problem of female recruitment to T&D was considered less difficult within girls' schools than it was in co-educational schools. One possible explanation offered by the teachers to explain this was that girls felt intimidated in the presence of boys within the T&D environment.

Assessment

In terms of the assessment of pupil learning within T&D, 70.4% of the teachers felt that the process was a major challenge. A number of reasons were presented to account for this including the time required to complete the assessment of project work and the nature, type and structure of it. It was suggested that the outcome of project work, the realised artefact, and consequently the marks awarded to it, did not always reflect the effort put into its design and manufacture. Teachers argued that it was possible for pupils to put in a lot of effort and yet finish up with a product that did not function, and therefore worthy of fewer marks. Similarly it was claimed to be possible for the opposite to occur, in that a relatively simple but yet fully functional piece of project work could achieve high marks but yet demand considerably less work and effort of the student concerned.

'Keeping everything on track'

The final challenge to the teacher of T&D in relation to the management of teaching and learning was concerned with 'keeping everything on track'. Demands originated, the teachers suggested, from preparation, assessment, administration, pupil management, pressures to improve examination results and satisfy inspections. In addition other subject specific issues were identified, such as the demand to deal with new material and the coming to terms with evolving subject matter. When this challenge was explored the teachers suggested that they, metaphorically, had to juggle many different elements of the course all at the same time. Typical examples as cited by the teachers, involved the management of different projects with numerous pieces of equipment and teaching resources placing. Other things to be 'kept on track' included maintaining records of projects, health and safety, and the preparation of teaching materials and resources. Consistent with previous research Eggleston (1993:63) notes that "running a Technology department has all the problems of running a middle size business enterprise. Yet few teachers have substantial business experience or training".

Professional development within Technology and Design

The second cluster of challenges for the teacher of T&D is concerned with professional development. The analysis indicated two particular issues that created demands for teachers, the first concerned with 'keeping up-to-date' and the second, with the development of subject knowledge.

'Keeping up-to-date'

Since the introduction of Education Reform all teachers have had to cope with change. However, in addition, T&D teachers have had to deal with fundamental changes in their subject. For example those who were employed in schools prior to that time were involved

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with the teaching of other subjects, and for these individuals Education Reform meant a substantial and unsettling change in their working lives (Fullan & Siegelbauer, 1991; Martin, 1998). One teacher reported being faced with a rather stark choice; either they took on board all of the changes and all the work and stresses that implementing this new subject involved or they faced the prospect of looking for another job. The subject area that they had taught for a number of years, CDT, no longer existed within the NI Curriculum. They suggested that this had created considerable stress for them because they now had to deal with new ways of working, subject content, teaching materials, and examination specification, resulting in a very steep learning curve which moved them from their 'comfort zone'.

Technology is evolving, changing at an ever-increasing pace and this is reflected in the curricular subject on offer. The teachers considered the need for them to 'keep up-to-date' with the rapidly changing nature of their subject to be a major challenge. Evans (1998) refers to the 'monochromatic teacher', the teacher who is highly specialised in one area but has limited breadth of understanding in the rest. The requirement to 'keep up-to-date' refers to a necessity to keep abreast with changes in relation to, for example, the processes being used, new materials and new software and the need to implement these in the classroom. A typical view expressed by one teacher was "the main challenge I suppose would be to a certain extent keeping up-to-date with the technology, new technology, new materials, new resources, ICT computer programmes and software". (Interview transcription)

Subject evolution leads to new knowledge, new processes and ways of doing things. Such changes create great stress for teachers and present them with considerable challenge (Barlex, 1998). Consequently, Stein et al. (2000) suggest one way for teachers to deal with such challenges is to centre their new experiences on prior knowledge and conceptualisations. However, a difficulty arises in that this does not always allow the subject to develop as it should. Interestingly, in contrast, it was suggested by some that keeping up-to-date was not a challenge but an opportunity.

Subject knowledge
Just over half (58.2%) believe the difficulties of teaching T&D are compounded by an increased workload

created due to subject changes. For example it was reported that "teacher workload is incredible and in all honesty only other Technology and Design teachers understand it". (Questionnaire: open-response section)

The majority (73.7%) said the volume of subject knowledge inherent within T&D made it a challenge to teach. Teachers, it was suggested, need to have an in-depth knowledge of a wide range of subject material including electronics, pneumatics, engineering and the ability to apply a wide range of craft skills as well as those of the artist, metalworker, woodworker, plastic worker, computer control expert, designer and systems engineer. Teachers who previously taught CDT explained that prior to the introduction of T&D they focused on a narrower body of subject knowledge. The introduction of this new subject had widened their field of work to include a new range of subject knowledge involving many different disciplines each demanding its own expertise. Eggleston (1993:63) suggests "at the heart of the problem is the inescapable fact that Technology has a far more demanding intellectual and expressive content than ever before".

The teachers suggested that for pupils the incorporation of 'new' technologies added substantially to the knowledge required because now they were expected to be experts in a diverse range of subject areas. Yet according to Davies (1997) it would be unfair to expect anyone in the world outside education to be an expert in each of the required areas. Due to the vastness of the knowledge and skills required teachers have less experience to call on and this potentially leads to lower levels of teacher confidence and even professional instability (Stein et al., 2000). One teacher perceived this situation to be 'a nightmare' and a small number compared their subject unfavourably to other subjects, which appeared to them not to have changed in any significant way. Undoubtedly T&D has and will continue to evolve which will no doubt result in many challenges for the classroom teacher.

The subject I now teach bears little or no resemblance to the subject I trained to teach i.e. CDT. As a consequence it required a large effort on my behalf to learn the many new skills and knowledge to be able to teach T&D. (Questionnaire: open-response section)

Most teachers agreed that many of the current developments were beneficial and highlighted the need

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for appropriate staff development. Most teachers (79.1%) agreed that it was a challenge to keep in touch with all of the new developments that were taking place within the subject. According to Stein et al. (2000) it is important to highlight to teachers the positive opportunities that can result from the introduction of innovation rather reinforcing any existing insecurities. Clearly staff development is important for any teacher and in particular for those in a rapidly changing subject such as T&D. Teachers who trained before the introduction of Education Reform or qualified to teach in a different area from T&D, not only need to try to keep pace with technology itself but need to 'catch up'.

Teaching Technology and the challenges involved
The third area of challenge focuses upon the actual teaching of technology and within this two further issues were identified. Rather negatively a minority of teachers of T&D suggested that if given the opportunity to choose a career again they would no longer be interested in teaching per se. When seeking to justify such a reaction these individuals highlighted a number of issues such as poor pupil behaviour, increasing workload, and the pressure to produce results although this may not be dissimilar to teachers from other subject areas. In addition to these general professional influences a minority of the teachers suggested that some pupils were poorly behaved in T&D because of the demands placed upon them by the current Programme of Study. Teachers from the non-grammar sector in particular considered this to be a major challenge.

A minority of teachers suggested that, if given a choice, they would want to teach a subject other than T&D because of the challenges that the subject presented. Such challenges, they suggested, filled them with anxiety. Interestingly almost half of the teachers (45.8%) agreed with the statement that teaching T&D caused them anxiety. One teacher described the situation in the following terms: "I find teaching T&D a complete nightmare". (Questionnaire: open-response section) Such anxiety resulted from different factors such as; pressure to cover the work as detailed within the Programme of Study, the management of coursework and project work, and the demands to interest pupils in the work.

Another source of anxiety, according to the teachers, related to the issue of health and safety. Adherence to numerous health and safety regulations along with a fear of potential litigation, coupled with an awareness of what was happening elsewhere in an ever-increasing claim conscious society proved to be a major challenge for teachers. Again, almost all the teachers were critical of the breadth of content that they were expected to address at KS3. Interestingly, a few had previously taught science or in some instances still taught science, and therefore were able to compare one subject against another. Clearly there is a need to address such areas so that pupils can be allowed to achieve their full potential and maximise the worth that the subject has to offer.

Conclusion

This paper sought to highlight a number of 'challenges' associated with the teaching and learning of T&D in the curriculum. The interconnectedness of the matters involved is clearly in evidence and therefore means that it is difficult to isolate particular issues. However, the key issues highlighted in relation to the challenges associated with the introduction of T&D into the curriculum were management of teaching and learning, and professional development within the subject.

The management of T&D raised a number of issues for teachers as they sought to implement the subject. Whilst project work is inherent to many subjects in the curriculum, the approach adopted within T&D makes it quite unique. The importance of project work to the subject was recognised but so also were the challenges associated with its implementation in the classroom. The drive to encourage the pupils to achieve individually in terms of project work created further challenges for teachers due to the limited curricular time available. The nature and volume of subject content also created problems, as did the need for skill development. Health and safety is a challenge that also has to be carefully managed and one often made more difficult by the actions of some pupils. Financial and technical support created challenges for the T&D teacher in their management of this new subject. Key issues raised were the importance of having appropriate technical support, a sufficient level of financial support to cover the running costs involved and a perceived differential in the level of funding between the grammar and non-grammar sectors. The perceived volume and nature of the subject content, detailed within the Programme of Study was also considered to be a challenge. As a result the amount of

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time required to implement the subject effectively was highlighted as a problem. Recruitment to T&D was also identified to be a challenge, which was affected by, perceptions of the subject's importance and the implementation of unfavourable subject groupings at option choice.

'Keeping everything on track' was identified as a key management issue in relation to the subject. Teachers were challenged not only by the diverse demands placed upon them but also by the accumulative effect of these. Whilst each of the tasks involved was a challenge in itself, when taken together the total effect was even more appreciable. Once again the changing nature of the content was highlighted, as was the need to keep pace with current developments within the subject. Such challenges were particularly noteworthy for those who had been teaching prior to the introduction of Education Reform and the introduction of T&D and the content changes that had resulted. A major challenge within T&D, consequently, was concerned with professional development in the subject, such as keeping up-to-date with constant and rapid changes, and the acquisition and consolidation of subject knowledge within the subject.

Finally a minority of teachers suggested that teaching T&D created great anxiety due to concerns about subject content, project work, health and safety, and the difficulty of securing pupil involvement. Those who teach and those who study T&D would claim, with justification, that it is a complex subject. It is one which requires hard work and effort, and presents many challenges and demands to those involved. Consequently it is important that expectations are realistic and feasible (Medway, 1989). One teacher summed up the challenges involved as follows: "I have taught many subjects in my career including English and science, and am of no doubt that T&D is by far the most demanding". (Questionnaire: open-response section)

It is quite clear that there are significant challenges for all involved in the teaching and learning associated with T&D and its implementation in the classroom; however the most difficult challenge of all may well be how best these can be addressed and acted upon in order that this 'new' subject can achieve its full potential.

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