Loughborough University

This item was submitted to Loughborough's Institutional Repository by the author and is made available under the following Creative Commons Licence conditions.

For the full text of this licence, please go to:
http://creativecommons.org/licenses/by-nc-nd/2.5/

Questioning the design and technology paradigm

Dr David Barlex, Brunel University and the Nuffield Foundation, UK

Abstract

In this paper I present a brief background to the questioning of the design and technology paradigm made by Andy Breckon before using the work of seven acknowledged experts in the field of design and technology education to scrutinise the validity and practicality of this questioning. The experts are David Layton, Richard Kimbell, Robert McCormick, Patricia Murphy, Mike Ive HMI, Malcolm Welch and Stephen Petrina. Next I consider the nature of design and technology within the school curriculum as if it were a brand competing for attention with other brands in the curriculum. I then use the experience of the Young Foresight Initiative to consider specifically Andy's position on design and technology innovation. Finally, I sum up by identifying future directions for the subject that have emerged from considering Andy's paper.

Background

In the September 2001 Issue of *Datanews*, Andy Breckon, the chief executive of DATA (the Design and Technology Association), published an article in which he challenged the design and technology paradigm (DATA, 2001). He deliberately took the drastic step of dividing design and technology into separate but related parts, acknowledging as he did so that those who are committed to a holistic view of design and technological activity would be critical of this stance.

He identified four components which should be assessed independently of one another:

- design and technological innovation
- design and technological knowledge
- design and technological issues
- design and technological application.

He based his argument on the need for the subject to reflect the 'unique contribution' statement at the beginning of the design and technology Orders (DfEE and QCA, 1999). This involved an appeal to the modernity of technology as it operates in the world outside school and an attempt to increase breadth whilst retaining significant designing and making. Underpinning Andy's argument, is the position that if an element of a school subject isn't assessed, then teachers will not teach it however an important contribution it may seem to make to the intellectual coherence of the subject.

At this point, it is important to clarify the use of the term 'paradigm'. In the context of a school subject, a paradigm is the sum of prevailing beliefs, theories, practices, values and attitudes that together define the nature of that subject. The term paradigm is most usually understood through the work of Thomas Kuhn who used it in the phrase 'paradigm shift' to describe the effect of developing a new and groundbreaking theory in science (Kuhn, 1996). Although Andy is asking uncomfortable questions, he has not actually moved outside the prevailing mindset of the community of practice so I do not believe that his challenge can be seen as having the potential to provoke a paradigm shift. However, it does require careful consideration as this may point to the way the subject should develop. To give his suggestions due consideration I will call upon the work of seven expert witnesses in the field of design and technology education, which, I believe, can shed light on the questions he asks.

Evidence from experts

My first expert witness is David Layton and his evidence is contained in the National Curriculum Design and Technology Working Group Interim Report (DES and Welsh Office, 1988), usually referred to as the Parke's Report. There is no doubt that David was the intellectual architect of design and technology as conceived for educational purposes within the National Curriculum. In the report he asks the question: 'What is it that pupils learn from design and technological activities which can be learnt in no other way?' He provides the answer: 'In its most general form, the answer to this question is in terms of capability to operate effectively and creatively in the made world. The goal is 'increased competence in the indeterminate zones of practice.' (DES and Welsh Office, 1988: 3) I can still remember both the excitement and puzzlement this answer provoked. Yes, that is what it's all about but how on earth do you teach 'competence in the indeterminate zones of practice'? David was careful to justify the use of the term 'design and technology':

> 'Our understanding is that whereas most, but not all, design activities will generally include technology and most technology activities will include design, there is not always total correspondence. Our use of design and technology as a unitary concept, to spoken in one breadth as it were, does not therefore embody redundancy. It is intended to emphasise the intimate connection between the two activities as well as to imply a concept which is broader than either design or technology individually and the whole of which we believe is educationally important. (Accordingly we use design and technology as a compound noun taking the singular form of verbs in what follows.)' (DES and Welsh Office, 1988: 2)

This justification is not something we should forget in the heady climate of today's technological world. Nor should we forget that design and technology is a construct designed specifically to meet the educational goal of teaching 'capability to operate effectively and creatively in the made world'. This is its greatest strength and also a weakness in that it ensures that it is not a subject with venerable roots in the academic tradition, which values particularly the acquisition of knowledge for its own sake. Here again, the report was clear in its thinking about the place of knowledge in design and technological activities.

> 'We have argued above that because knowledge is a resource to be used, as a means to an end, it should not be the prime characteristic of attainment targets for design and technology. This is not to devalue knowledge, but rather to locate it in our scheme according to its function. What is crucial

here is that knowledge is not possessed only in propositional form ('knowing that'), but that it becomes active by being integrated into the imagining, decision-making, modelling, making, evaluating and other processes which constitute design and technological activity.'
> (DES and Welsh Office, 1988: 29–30)

I think this indicates that David would have little sympathy with a separate assessment of design and technological knowledge. I will return to the place of knowledge within design and technology later in the evidence of Robert McCormick. It is also worth noting the difficulties that have been created for science in the curriculum with an over emphasis on knowledge. The Nuffield Foundation published Beyond 2000: *Science Education for the Future*. (Millar, R. and Osborne, J., 1998) The report paints a picture of a secondary school science curriculum that has lost its sense of purpose and its effectiveness, citing in particular the role of knowledge within this:

> ' ... an over-emphasis on content which is often taught in isolation from the kinds of contexts which could provide essential relevance and meaning ... Assessment is based on exercises and tasks that rely heavily on memorisation and recall, and are quite unlike those contexts in which learners might wish to use science knowledge and skills in later life.'
> (Millar, R. and Osborne, J., 1998: 2005)

The effect of content-based assessment on the science curriculum should perhaps sound warning bells with regard to an assessment of design and technological knowledge.

My second expert witness is Richard Kimbell and his evidence stems from his acknowledged expertise in assessing design and technology (Kimbell, 1997) and his most recent publication (Kimbell and Perry, 2001) in which he articulates the particular contribution of design and technology as a school subject. Richard clearly sees design and technology as providing a way of teaching and learning that is unique in our school curriculum. He identifies strongly with David Layton's 'ability to intervene effectively and creatively in the made world' as a main aim for design and technology education. He explains clearly why tackling designing and making assignments is an essential pedagogy to achieve this aim.

> 'At the heart of the development lies a fundamental shift of emphasis from the study of technological outcomes (making them and understanding their social impact) to the exercise of a technological process (of design, development, manufacture and testing) that generates the

outcomes. We should not underestimate the massive significance of this move – particularly in the context of pupils' learning in schools. It is a move from receiving 'hand-me-down' outcomes and truths to a situation in which we generate our own truths. The pupil is transformed from being a passive recipient into active participant. Not so much studying technology as being a technologist.'

(Kimbell, R. and Perry, D., 2001: 7)

This stance leads him inexorably to the position where the assessment of pupils' procedural competence should take precedence over other forms of assessment. He is committed to a holistic approach to such assessment, castigating developments over the past 20 years that have led to an ever-increasing atomistic approach to assessment. (Kimbell, 1997) His research (Kimbell et al, 1991), has shown that teachers' use of holistic assessment is both valid and reliable. He has welcomed the return of a single attainment target for design and technology so not surprisingly I conclude that Richard is firmly opposed to any suggestion that this assessment be fragmented and that he sees any endorsement of Andy's suggestions as retrograde.

My third expert witness is Robert McCormick and his evidence stems from his consideration of the role of knowledge in design and technological capability. He takes as his starting point, the significance of the place of knowledge in capability (recognised in the Parke's Report that formulated design and technology), but asks about the nature of the interaction between knowledge and procedural competence that has become almost synonymous with design and technological capability.

'The role of using 'knowledge' has always been present in ideas of capability, but its relationship to the 'process' is ill-defined, as is how knowledge is used in action. Although we started with a clear focus on both action and the combination of knowledge and process, we have moved the focus to process alone, leaving the role of knowledge unclear.'

(McCormick, R., 2002: 93)

Bob develops the argument that the way knowledge is organised and used is highly context dependent. It is often the context that gives an overriding purpose to the use of the knowledge in question, and in school subjects this purpose will vary considerably from subject to subject. For example, in science lessons the aim of the teaching of simple electrical circuits is likely to be to enable pupils to use the abstract concepts of current flow and potential difference to explain the difference in behaviour of parallel and series circuits. In design and technology, the 'same'

knowledge when used to make design decisions about the lighting circuits in a small puppet theatre, will be represented and conceived quite differently; the conception having a much wider range of significant features. The circuit diagram will be drawn using the top and bottom rail convention. Then it has to become a layout diagram, the layout diagram which has to engage with how the wiring and components align with and are attached to the theatre. The ease with which burnt out bulbs can be replaced will be a consideration. An additional consideration will be the placing of the bulbs so that they give the light in the required place and do not cause over-heating. Overlaid on this will be the placing of switches to control the lights and here, while the placing of the switches in the correct position in a circuit diagram may be a relatively simple affair, placing them in the layout diagram so that they are convenient to use will be a more demanding task. There is also the issue of choosing from a range of switch types. Bob notes that knowledge of devices or systems is the knowledge that experts use when they tackle tasks (Gott, 1988). He goes further, arguing that the way experts use device knowledge is qualitative and that this is a key feature of technological thinking and one which those teaching design and technology should take seriously. He concludes as follows:

'The way those involved in design and technology have refined their views on processes, albeit slowly, now needs to be developed to incorporate those of knowledge. My exploration of this kind of knowledge has sought to suggest that we should not look in the first instance to the abstraction of science and mathematics, but to the practical knowledge used by technologists. This search does not imply a swing from 'process' to 'knowledge', but the search for the relationship of the two. Nor does this imply that science and mathematics are to be ignored but that their role in the design and technology lesson may be more complex than assumed.'

(McCormick, R., 2002: 105)

This clearly indicates that design and technology knowledge is very complicated territory. As knowledge in action, it is context dependent and not abstracted in terms of concepts that can only exist in an idealised world. I think that the insights provided by Bob's careful analysis indicate that assessing design and technology knowledge separately from the way in which it is being used procedurally is a contradiction in terms. It is only design and technology knowledge when it is being used in tackling a real world problem.

My fourth expert witness is Patricia Murphy and her evidence stems from her work on co-operative

problem solving in design and technology. From a survey of the literature, Patricia draws this conclusion:

> 'Collaboration is an important aspect of problem solving which enhances learning (including planning) by making thinking more explicit and accessible and enabling pupils to construct joint understanding of tasks and solutions. In the case of design and technology, we would expect procedural knowledge to become more explicit.'
> (Hennessy and Murphy, 1999: 27)

Patricia has identified an optimal set of preconditions for collaboration in the design and technology classroom for investigation and analysing peer collaboration. It involves five categories: teacher commitment and understanding of collaboration, a task context, school and classroom organisation, pedagogic strategies and pupil perspectives. She has reservations about how often this situation pertains.

> 'These conditions are unfortunately somewhat rare in secondary schools' but 'in the right circumstances, then, we predict that rich opportunities will arise for shared thinking and joint decision-making.'
> (Hennessy and Murphy, 1999: 29)

In a follow-up to the literature survey, Patricia undertook detailed observation of two boys aged 13 in a class that the teacher had organised so that pupils worked in pairs for the purpose of designing and making aids for the handicapped. The observation took place over eight weeks with one 3-hour lesson each week. Her report makes sorry reading (Murphy and Hennessy, 2001). The title of the articles reveals her concerns, 'Realising the Potential – and Lost Opportunities – for Peer Collaboration in a Design and Technology Setting'. The lost opportunities resulted, to a large extent, from the teacher's perception that any worthwhile learning taking place would ultimately be both embedded in and revealed by the quality of the artefact the pupils produced. This guided the interaction of the teacher with the pupils and the extent to which the teacher supported the interaction of the pupils with one another. Her verdict is severe.

> 'In our analyses we found that the teacher lacked an understanding of collaboration as a learning mechanism. He would therefore be unaware of the demands it places on students. We have identified the need for teachers to address dissonance within groups and to recognise when collaboration is no longer constructive. Not only was this not done, the teacher, in some respects, albeit unwittingly,

> supported the unequal participation of the two individuals.'
> (Murphy and Hennessy, 2001: 235)

Patricia believes passionately in the benefits of collaborative learning but is well aware that the gatekeeper to these benefits is the teacher. In this case, the teacher was inept although in other respects he seemed an ideal candidate, a head of department, enthusiastic and highly experienced. This points very clearly to the role of professional development in convincing teachers of the benefits of such approaches to pupils' learning. I will return to this issue when I develop my personal perspective on design and technology innovation. Given Patricia's concern about the ways that good learning in design and technology can be enhanced by innovative classroom practice, I believe she would regard Andy's division of design and technology into four related yet independently assessed elements, as a complete irrelevance. She would see it as nothing more than a red herring, a distraction that takes our attention away from the central issue – the quality of pupils' learning.

My fifth expert witness is Mike Ive and his evidence is contained in his work analysing inspection evidence carried out for the Office for Standards in Education. He produced a useful 'state of the nation' summary in 1998 (OFSTED, 1998) which indicated clearly the progress made by design and technology since its introduction into the National Curriculum. From a low base, the percentage of design and technology lessons graded as good by OFSTED, increased steadily to the point where the percentage of such lessons at both Key Stage 3 and Key Stage 4 was greater than the percentage of good science lessons. Clearly teachers were making progress at getting to grips with the new subject. There are still issues remaining and Mike has recently noted these (OFSTED, 2000). Two are particularly noteworthy.

Firstly, pupils' designing ability still lags behind their ability to make. This is a cause for concern because it is design ability that many see as the indispensable element in pupils' procedural competence that lies at the heart of the educational rationale for design and technology. I have to ask whether any of the proposals in Andy's challenge are likely to lead to an increase in pupils' design ability. There is no doubt that his view of design and technological innovation has this in mind, but it is not clear whether this would actually spill over into pupils' ability in design and technological application. Some would certainly argue that if it didn't do this then it would be a fantasy ability not rooted in the pupils' capability. The situation is made worse by inappropriate use of the design portfolio, criticised by Mike in the following terms:

'In many schools, however, attainment is limited because pupils spend too much time on superficial work associated with the presentation of their design portfolios at the expense of the main core of designing and making activities.'
(OFSTED, 2000: 2)

Nick Givens, of Exeter University, writes passionately about this:

'Our problem always has been, and remains, that of finding efficient painless ways of generating evidence that don't stifle the creativity. So the ritualisation of designing, the conversion of the design folio into a product and the inflexible narrow interpretation of what constitutes design, represent a major problem. There needs to be scope for pupils to model and record their thinking in a variety of ways and orders. We can't carry on letting a narrow view of what constitutes evidence-of-design dictate the nature of design.'
(Givens, 1998: 3)

I will demonstrate later that it is quite possible to develop pupils' design ability in the way that Andy envisages through a separately assessed design and technological innovation element within current arrangements.

Secondly, more able pupils often underachieve. This is a particularly serious weakness as design and technology is extolled for its potential to engage pupils of widely different abilities and learning styles (Kimbel and Perry 2001). Will the elements in Andy's proposal result in engaging more able pupils to a greater extent? Some would argue that if teachers cannot utilise the challenges posed by open-ended designing and making project work to engage able pupils, then the whole of design and technology is a lost cause. I do not go as far as this but I do see the formulaic approach adopted by some teachers in producing portfolios for GCSE coursework, as contributing to this malaise. Mike Ive has noted this.

'There is increasing evidence that teachers provide coaching which allows pupils to pass through the assessment 'hoops' for design and technology GCSE coursework at the expense of following the rationale of wider design and technology learning objectives.'
(OFSTED, 2000: 3)

It is not easy to provide the different and appropriate support needed by pupils of differing ability when they are tackling a designing and making assignment and I see this as an issue concerned with enabling teachers to develop and use appropriate pedagogy. It is an issue that can be resolved by the provision of appropriate continuing professional development rather than a revision of the curriculum.

Therefore, I conclude that two important causes of concern identified through OFSTED inspections are unlikely to be resolved by adopting Andy's suggested approaches.

My sixth expert witness is Malcolm Welch and his evidence stems from his work on the way children actually generate and develop design ideas. Malcolm has analysed video tape recordings of pupil pairs tackling various design tasks and then subjected everything the pupils say and do to rigorous protocol analysis (Welch, 1998; Welch and Lim, 2000; Welch, Barlex, and Lim, 2000). He concludes from these observations that an insistence on sketching as the predominant mode of generating and developing design ideas may be very limiting for many pupils. For naïve designers, whose sketching skills are of necessity limited, discussion combined with 3D modelling offer opportunities not afforded by sketching alone. He also noted that situating the tasks in an appropriate context enhances pupils' abilities to generate and develop design ideas. This work challenges conventional practice where an insistence on sketching as the majority means of generating and developing design ideas, is seen almost as de rigeur. As with Patricia Murphy, I believe that Malcolm's work would lead him to a position where he sees Andy's division of design and technology into four related yet independently assessed elements as mildly engaging but not really where our focus of attention should be. He argues that his research has allowed him to identify a wide range of issues that remain to be resolved given the centrality of modelling to the designer maker capability required by current design and technology curricula:

- Is the modelling strategy used by pupils a function of the task?
- Would design and make tasks oriented towards 2D activities involve different modelling strategies from pupils?
- Which modelling strategies should be taught?
- What is the most appropriate sequence in which to teach modelling strategies? How does this sequence map on to the age and ability of the pupil?
- What is the most effective way to enable pupils to choose and use modelling strategies appropriately?
- What contribution does learning to model ideas make to the overall cognitive development of the pupil?
(Welch, M., Barlex, D. and Lim, H.S., 2000: 144)

My seventh expert witness is Stephen Petrina and his evidence stems from his critiques of technology education from a variety of perspectives (Petrina, 1993, Petrina, 1998, Petrina, 2000). Stephen argues

that technology education, as enacted by most teachers in most classrooms, is orchestrated by the interests of business and industry. This has technological literacy operating within a mind set that does not challenge the notion that a fundamental aim of technology education is to provide a workforce dedicated to working towards competitive supremacy. He provides an alternative model for technological literacy, one that embraces criticism from perspectives that are overtly political and challenge the assumptions hidden within conventional technology literacy rationales. He articulates the advantages of 'Crit Tech' (critical technological literacy) over 'Tech Ed' (conventional technological literacy).

> 'Without the strings attached to business and industry which control the movement and rhetoric of 'Tech Ed', 'Crit Tech' is free to collectively organise and agitate to say 'no' to competitive supremacy, ecological destruction, exploitative practices of globalisation, homophobic aggression, racist structures and sexist displays of masculinity.'
> (Petrina, S., 2000: 201)

There is clearly resonance between Stephen's concern for a critical technological literacy and Andy's concern for assessment of design and technological issues. Few would argue against an important feature of design and technology education as being to enable pupils to articulate their concerns about the way technology operates within our society. Stephen has not to my knowledge written about exactly how to introduce his vision of 'Crit Tech' into the classroom and here is the rub – there is real potential for over-intellectualisation of the design and technology curriculum with consequent alienation of both teachers and pupils. Of course Stephen would argue, with some validity, that there is probably a good deal of alienation towards the current 'Tech Ed' offering. Many design and technology teachers have very little if any experience or expertise in this field, although there are other areas of the curriculum in which this does exist. Therefore, an interesting way forward might be to work with colleagues from other subjects. However, without significant and substantial professional development most design and technology teachers would find this a daunting task. Assessing a pupil's understanding of design and technology issues will not be easy. Many pupils will be severely challenged by free response essay writing and some would argue that it is the way pupils act in response towards issues that is important, not what they write about it. I wonder if it is possible to engage pupils with a critical study of technology within their designing and making assignments, particularly at GCSE level. In all focus areas, pupils will be developing to working prototype stage a sophisticated artefact of some sort. Asking the candidate to engage

in the following three related and complementary activities would be an interesting way of providing a framework for critical study.

1. Imagine that your product is to be manufactured. Carry out a 'Cradle to Grave Product Life Cycle Analysis' to show the impact of your product.
2. Imagine that your product is to be manufactured. Carry out a 'Winners and Losers' analysis to identify how different groups will be affected by your product.
3. Using criteria for appropriate technology think about your product and decide whether it is appropriate.

Asking pupils to evaluate any products from these perspectives has the potential to engage them with critical studies. Requiring them to do this for the products that they have designed and made, and to which they have made considerable emotional and intellectual commitment, might well result in the potential engagement becoming actual. This is new territory for design and technology, both in teaching and assessment. It will require significant work to ensure success.

Therefore, I am again brought to the view that highly desirable though a focus on design and technology issues is, it is not necessary to separate it out for special treatment. In fact to do this might well result in this feature becoming such a bone of contention. that its potential for engaging pupils in critical thought is lost.

A different point of view
I now want to change tack completely and consider the position of design and technology in the curriculum as if it were a brand, in competition with the other brands i.e. other school subjects, in the educational market place. To begin with I need to give an example of a successful brand so that I can develop the discussion by analogy. I choose for my example Absolut Vodka. The branding here is highly innovative in that the product itself is almost invisible – the blank bottle shaped space provides a window in which the advertiser can place content that will appeal to particular audiences. In *Harper's* the content is intellectual; in *Wired* it is futuristic; in *Spin* alternative; in *Out* it is loud and proud; with 'Absolut Centrefold' in *Playboy*. Here the product is like a chameleon taking on, not colours from its surroundings, but areas of interest and associated values that will appeal to particular market sectors. This is brilliant – a brand that has equal appeal to widely diverse groups – gay men, fashion conscious women, young techno males, straight men and those interested in politics. The key here is that the

branding appeals to the values, interests and lifestyles of particular groups and this is the way the product differentiates itself from other 'drinks on the shelf'. Here is where the analogy with design and technology as a subject in the school curriculum and a brand begins. Subjects are expected to have boundaries by which they are clearly defined, inside which sit their bodies of knowledge, tests of truth and accepted techniques – just as a brand defines itself so that it is recognisable and differentiated. And this is where the problem for design and technology begins, clearly captured by Richard Kimbell:

> 'Part of the discomfort that has been experienced by design and technology over the last 30 years arises from its awkward insistence on being neither a specialist art nor a specialist science. It is deliberately and actively interdisciplinary. The design sub-label leans towards the arts, and the technology towards the sciences. But neither will do as a natural home. It is restive, itinerant, non-discipline.'
> (Kimbell, R. and Perry, D., 2001: 19)

So I see design and technology as a brand to be analogous to Absolut Vodka. It can take up a variety of positions along an art–science spectrum. Indeed pupils will adopt many different positions along such a spectrum as they move through a single designing and making project. It can appeal to a wide variety of learning styles. It can generate educational outcomes in many different domains. Yet if we are not careful, this very adaptability and flexibility will be seen as a weakness.

> 'Just what is this design and technology? It's not a subject like the rest of the subjects in the curriculum. That can't be right.'

Andy's division of design and technology into four related yet independently assessed elements can be seen as an attempt to give the design and technology brand some of the features recognisable in other brands – clearer boundaries, especially defined and testable knowledge. Yet I believe the subject needs to be true to its core values. To look to become more like other subjects would be to sell out on what we have to offer our pupils. It is not comfortable being a rogue brand when your unique selling proposition may not always be seen as an advantage. It's a risky position. Yet the biggest risk is no risk at all. The very nature of the rest of the curriculum tests us. This, however, can be seen as an advantage from a Darwinist perspective. It makes us strong.

A perspective on design and technology innovation
It is to design and technology innovation that I now turn, as this is the very element of design and technology that the Young Foresight initiative addresses (Barlex, 2001). I have the responsibility for being the educational manager for Young Foresight. Like Andy's design and technology innovation, Young Foresight requires designing without making and while this may seem to go against the core values of design and technology, it does have several advantages providing it is not taken to extremes. The Young Foresight programme has been designed to take a maximum of one term in Year 9, although many schools do not use this amount of time. It provides the opportunity for pupils to engage with the potential of new and emerging technologies. It increases their scope for response because they are not restricted by limitations of materials, tools and techniques available to schools. It is suited to group work. It needs to be future orientated if it is to be genuinely innovative. It is highly relevant to young people incorporating most features of the unique contribution statement and clearly reflects a broad approach to technology. It is only feasible if teachers receive appropriate in-service training and even then it will be challenging for many in the profession. There is clear evidence for this from the Young Foresight Pilot. Through a combination of industrial sponsorship and funding from the DTI and the DfES, Young Foresight is able to provide appropriate curriculum materials and associated professional development to support this component. Assessing pupils engaged in this activity will be challenging, as it will require the work of teams to be assessed with a key component of the assessment being how well the pupils worked together as a team. It may also require the achievement of individuals within the team to be assessed. Design and technology has shied away from assessing group activity although groups rather than individuals invariably carry out innovative practice in the world outside school. Developments in this field are long overdue. The production of a group portfolio linked to a presentation made by the group to peers and teachers will provide a valid and reliable means of assessment.

Yet I have to ask if we actually need to separate out this component from design and technology as a whole. All the teachers who have so far taken part in the initiative – well over 200 – have been able to include it as part of their current National Curriculum offering. Indeed, one of the reasons they are attracted to being involved is because Young Foresight helps them deal with two areas of acknowledged difficulty – developing designing skills and product evaluation ability. Young Foresight has some anecdotal evidence that this approach has some long-term benefits. Several teachers who took part in the Pilot phase and taught Young Foresight to pupils in Year 9 have commented on the improved ability of pupils in their subsequent GCSE courses. They note particularly these pupils' ability to learn collaboratively as well as

their enhanced designing ability. This indicates to me that within current arrangements, teachers can teach design and technology innovation to the benefit of their pupils' overall design and technology capability so I am highly suspicious of the need to identify it as a separately assessed element.

Summing up

My overall conclusion therefore is to resist thoroughly Andy's attempts at fragmentation, well meaning though they are. The profession should operate within the current statutory arrangement or minor modifications thereof, and focus on the following to enable the subject to develop:

- Engage with curriculum development initiatives that target areas of known difficulty.
- Concentrate on identifying, developing and promoting better pedagogy particularly those that capitalise on collaborative learning.
- Develop assessment regimes that are sensitive to preferred learning styles and allow the individual signature of the candidate to be revealed by they way they are encouraged to make and record design decisions.

There are clearly issues here relating to both initial teacher education and continuing professional development within design and technology.
DATA is in a strong position to show leadership here and establish this agenda as the way forward for the subject in the short and medium term. To do anything less will be to put in jeopardy the achievements of the literally thousands of design and technology teachers who have helped shape the subject through intense personal reflection and a demanding revision of their professional practice. To respond to the questioning of the design and technology paradigm as formulated by Andy Breckon by simply acquiescing to its demands would be a betrayal. A betrayal of the unique nature of design and technology, that rare creature in any curriculum – one that has been designed specifically to meet the needs of pupils in a way that empowers them for life in an uncertain world. I conclude with a quote from David Layton who was kind enough to comment on my original manuscript. He said, 'I am glad you hold on to the uniqueness of design and technology: its challenge is formidable, but its educational potential is enormous.'

Summary

In this paper I have used the work of seven acknowledged experts in the field of design and technology education and my own experience in the Young Foresight Initiative to scrutinise Andy Breckon's contention that design and technology can be viewed as a complex of four related elements that should be assessed individually. These elements are design and technological innovation, design and technological knowledge, design and technological issues, and design and technological application. To clarify the unique nature of design and technology in the curriculum, I have considered it as a brand. Through these endeavours I believe that I have shown quite conclusively that Andy's contentions are ill-founded. I advise that a much better approach to enhancing design and technology can be found by focusing attention on curriculum development that targets areas of known difficulty, appropriate pedagogy and appropriate assessment devices within the current or slightly modified statutory arrangements.

References

Barlex, D. (2001) Young Foresight from Paper presented at the eleventh PATT (*Pupils Attitudes Towards Technology*) *Conference*, the Netherlands: Harlem [Paper published in refereed conference proceedings]

DATA (2001) 'DATA Chief Executive challenges design and technology paradigm', in *Datanews*, 18

DES and Welsh Office (1988) *National Curriculum Design and Technology Working Group INTERIM REPORT*, London, UK: DES and Welsh Office

Department for Education and Employment/Qualifications and Curriculum Authority (1999) *The National Curriculum for England*, London: DfEE/QCA

Givens, N. (1998) *Nuffield D&T Project response to the National Advisory Committee on Creative and Cultural Education*

Gott, S.H. (1988) 'Apprenticeship instruction for real-world tasks: the co-ordination of procedures, mental models and strategies' in Rothkopf, E.Z. (Ed) *Review of Research in Education* 15: 97–169, Washington DC: American Educational Research Association

Hennessy, S. and Murphy, P. (1999) 'The Potential for Collaborative Problem Solving in Design and Technology' in *International Journal of Technology and Design Education*, 9 (1): 1–36

Kimbell, R., Stables, K., Wheeler, T., Wosniak, A., and Kelly, V. (1991) *The Assessment of performance in design and technology: Final Report*, London: Schools Examination and Assessment Council

Kimbell, R. (1997) *Assessing Technology International Trends in Curriculum and Assessment*, Buckingham, England and Philadelphia, USA: Open University Press

Kimbell, R. and Perry, D. (2001) *Design and Technology in a Knowledge Economy*, London: The Engineering Council

Kuhn, T. (1996) *The Structure of Scientific Revolutions*, Chicago: University of Chicago Press

McCormick, R. (2002) 'Capability lost and found?', Owen Jackson, G. (Ed) *Teaching Design and Technology in Secondary Schools*, London and New York: Routledge Falmer

Millar, R. and Osborne, J. (1998) *Beyond 2000 – Science Education for the Future*, London: Kings College London, School of Education

Murphy, P. and Hennessy, S. (2001) 'Realising the Potential – and Lost Opportunities – for Peer Collaboration in a Design and Technology Setting' in *International Journal of Technology and Design Education*, 11 (3): 203-237

OFSTED (2000) *OFSTED Subject Reports Secondary Design and Technology, 1999–2000*, London: The Stationary Office

OFSTED (1998) *Secondary Education 1993–97: A Review of Secondary Schools in England*, London: The Stationary Office

Petrina, S. (1993) 'Under the Corporate Thumbs: Trouble with our MATE (Modular Approach to Technology Education)' in *Journal of Technology Education* 5 (1): 72–80

Petrina, S. (1998) 'Men at Work: Inspecting the Foundations of Technology Education', in *Journal of Technology Education* 36 (1): 99–121

Petrina, S. (2000) 'The Politics of Technological Literacy', in *International Journal of Technology and Design Education, 8: 241–260*

Welch, M. (1998) 'Students' use of three-dimensional modelling while designing and making a solution to a technological problem', in *International Journal of Technology and Design Education*, 8: 241–260

Welch, M., and Lim, H.S. (2000) 'The strategic thinking of novice designers: Discontinuity between theory and practice', in *The Journal of Technology Studies*: 25 (2): 34–44

Welch, M., Barlex, D. and Lim, H.S. (2000) 'Sketching: Friend or foe to the novice designer', in *International Journal of Technology and Design Education*, 10: 125-148