

'Times change and we change with them' or do we?: A new paradigm for design and technology

Abstract

With the ink barely dry on the last National Curriculum document for England, the debate as to the appropriateness of the paradigm that exists for design and technology is gaining momentum. Just as educators in all sectors thought that there might be a period of stability and consolidation, frameworks could be rebuilt, planning redrawn and delivery and resources redesigned. Is it appropriate and realistic to suggest that changes occur so quickly? Rather than raise standards, will it encourage educators to side step any changes, or even withdraw altogether from teaching the subject?

A study of design and technology, since its introduction in 1990, indicates that in fact, there has never been a period of stability. Documents have come and gone as the design and technology community struggled to create a paradigm that was thought appropriate and acceptable to the majority. It is impossible to know exactly how implementation and standards were affected by this constant change, but there is evidence to suggest that progress would have been greater if stability had reigned.

Yet is the situation different now? Is there sufficient agreement and have solid foundations been laid, upon which a different paradigm can be grafted that will enhance the subject and allow it to keep pace with the changing world? With the publication of the last curriculum, there was a consensus that the statement outlining the importance of design and technology was a true reflection of what most believed to be at the heart of design and technology. Furthermore, it is the very first sentence of that statement that supports the notion of a possible new paradigm. If young people are to be prepared to participate in tomorrow's rapidly changing technologies, then surely the curriculum must reflect these rapid changes – constantly.

Using recent evidence, including a wide range of case studies written by primary teachers, it will be argued that we have a flexible framework that has been created from the experiences of the last ten years. Parts that are no longer appropriate can be removed, whilst new areas can be slotted in without destroying the good practice that is already evident in our schools. We must consider the paradigm in relation to young people in early years and primary education if we are to create exciting designers and makers in the future. The new paradigm must take into account, not only the 'new' technologies, but also design and technology and society, a strand that has been neglected more recently. Moreover, it is not enough to create the model but a paradigm has to be created for its delivery. This is one past mistake that cannot be repeated.

The purpose of the paper will be to highlight why we cannot afford to remain static, to suggest a new paradigm from a primary perspective thus ensuring that building blocks are in place and to indicate how implementation can be successfully achieved.

Introduction

Since the last review of the National Curriculum and the publication of the current Order (DfEE, 1999), there have been two significant highlights that have provided all in the design and technology community with important pointers for the future direction of the subject. Firstly, David Hargreaves (2000) chose to focus on the importance of design and technology for young people when speaking at the London Institute of Education. He stated that the subject is moving from the periphery to the heart of the curriculum; it is a bridge that supports curriculum coherence; it is fertile ground for activities that support innovation; and it is a subject that has undergone rapid evolution. Secondly, Andy Breckon, former chief executive of DATA, presented a paper at the Third International Primary Design and Technology Conference (2001a), outlining a new paradigm for the subject. He challenged the community to engage in debate to ensure that the evolution of design and technology continued and reflected the world, not only of today, but also

of the future. His paper focused on the primary curriculum and he later expanded his ideas to include secondary education in an article in *Datanews*. (2001b) This challenge, in the main, has gone unheeded, but if the subject is to keep pace and 'prepare pupils to participate in tomorrow's rapidly changing technologies' (DfEE, 1999), we must constantly consider the appropriateness of the paradigm and be prepared to be proactive rather than reactive in any future curriculum review.

It should be obvious to all involved in creating and shaping a curriculum that it is essential to consider the 'foundations', rather than to start with the 'walls'. However, in reviewing the many models that exist, it is almost always the case that little consideration is given to the foundation and primary phases (F&PP) in education, but rather secondary and further education appear to assume the primary position. It is for this reason that this paper will seek to provide a review of the current position in the F&PP, noting lessons learnt, and offer a paradigm that will allow design

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and technology to move forward, taking account of our rapidly changing world but building on past successes. It would then be possible for other phases in education to take this paradigm and build on it to create one relevant to their needs.

Setting the context – an historical perspective

Before setting out to offer ideas for a future paradigm for design and technology, it is important to reflect on what has gone before to ensure that lessons learnt could be considered and possibly incorporated into new developments.

This 'new' subject

When design and technology was introduced into the primary curriculum twelve years ago, there were few teachers who had a clear understanding of the nature of design and technology, who had training to support its delivery and who had few, if any, relevant resources to draw on. In creating the paradigm, there had been little open consultation and very few primary teachers involved in its creation. In reviewing the document today, it is apparent that much that was exciting and relevant has been lost. It certainly offered a breadth that slowly disappeared over subsequent documents – cultural and environmental considerations, times past, industrial and economic links and group work. However, the sheer length of the document, the language used and the amount of content were just three of the obstacles that had to be overcome, and certainly future deliberations took these into account when changes were being discussed. Nor did the paradigm, or any of those subsequently, focus on the inclusion of creativity and innovation.

Times certainly changed!

Between 1990-1995, there were more consultations, draft and final documents produced than for any other subject in the curriculum. Many, and in particular, teachers, argued that change was needed to make the National Curriculum workable in the classroom, but the constant changes did not appear to be based on research evidence, consultation or, more importantly, the 'rapidly changing technologies'. (DfEE, 1999) When consultations were carried out, the findings were sometimes not considered as changes were finalised. A crucial factor was that of 'slimming down', often without regard for the importance or relevance of content. Much time at conferences was devoted to a discussion as to the nature of the subject, without consensus being reached or decisions made with regard to practical support for those in the classroom. Design and technology was often characterised and referred to as the

'Blue Peter' or 'Mickey Mouse' approach (Flood, 1991), resulting in poor quality outcomes and little structure to any activities.

1995 – a watershed

The revised National Curriculum (DfEE, 1995) for primary design and technology, finally offered teachers a model that was relatively clear, had content that was considered relevant and realistic, and a workable structure, through investigative, disassembly and evaluative activities (IDEAS), focused practical tasks (FPTs), and design and make assignments (DMA). Subsequently, OFSTED (1998) identified the use of these activities as an important factor in the rising standards for the delivery of design and technology in the classroom. It was apparent therefore that change was possible in a short space of time if a new model could be seen to be relevant, realistic and providing support for teaching and learning.

Additional support was given to the paradigm with the creation of the exemplar Scheme of Work for Key Stages 1 and 2. (QCA, 1998) From the DATA primary survey (2001), it is evident that the scheme has quickly become established in schools; indeed 81% of schools in the sample are using all or part of it, providing further proof that change can be brought about quickly using a document, that teachers feel is useful, relevant and easy to access. Comments have been made that the scheme stifles the creativity of the teachers in implementing the subject and that children face the prospect of being involved in narrow, repetitive projects. This is not the case. The scheme is for guidance only. It offers those who need support, a framework within which to work. For those who are able and willing, it can be changed to suit the needs of all children; different contexts can be chosen and different emphases placed on the different materials, knowledge and skills that are used.

Until 1996, there had not been a mandatory curriculum for Early Years (aged 3-5 years) education. However, one was outlined in Desirable Outcomes (SCAA, 1996), followed by exemplification material – Looking at Children's Learning (SCAA, 1997). Whilst design and technology was included in 'Knowledge and Understanding of the World', the content offered was generalised and lacked the rigour and detail that was necessary to aid teachers in providing appropriate, balanced activities to support teaching and learning in the subject.

The foundation stage and Curriculum 2000

The foundation stage was created for children aged 3-6 years, a revised order published – Early Learning Goals (DfEE/QCA, 1999) – and additional guidance offered. (DfEE/QCA, 2000) Little additional support relating to 'designerly and technological' activities is included in the section on Knowledge and Understanding of the World. Nevertheless, statements, that support a paradigm in which design and technology is about exploring products and materials, (how things work, learning knowledge and skills as appropriate, working together, selecting tools and materials, making things, evaluating, finding out about other cultures, times past and their environment), are included throughout the document. The key criterion in the 2000 National Curriculum review was to 'slim down' the document that teachers were to receive, with little regard for changes resulting from changing technologies or 'lessons learnt' over the last five years. As a result, for example, the word 'disassemble' was taken out and structures disappeared as a discrete section; neither change was based on hard evidence that this would develop or improve the order.

However, a significant achievement was the inclusion of a preface to the programmes of study that was created through discussion and debate setting out the importance of design and technology. It is this statement that should form the basis of any changes to, or creation of, a paradigm for the subject in the future.

Present times

The present position of primary design and technology is encouraging. Schools are beginning to look at foundation subjects once more to provide a broader curriculum; standards overall are rising (OFSTED 1999, 2000); the present model is clear and manageable; there are materials that provide all primary practitioners with guidance for planning at all levels, with support for knowledge and understanding, and with evidence of good practice through case studies.

However, there is still much to be done. Designing skills, the use of ICT and assessment are all areas that need further support. The model that we have does not match the statement of the importance of design and technology (DfEE, 1999) in many respects and this needs to be addressed. In particular, the use of ICT and new materials has already moved on from 1999 and we need to create a paradigm that will take account of these changes.

Current model:

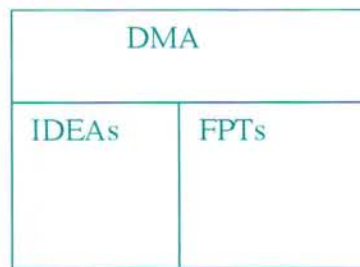


Figure 1.

A figure that is often used (DATA, 1996) to illustrate the current paradigm is based on a building block figure. The content is fitted into the three sections and it is used to show the supporting role that the IDEAS and FPTs play and their relationship to the DMA. However, it is not easy to show changes to the importance of the relationship between the three parts, or to show what, if any part, is more central to design and technology. A different model will be offered which would address these issues.

A paradigm for the future

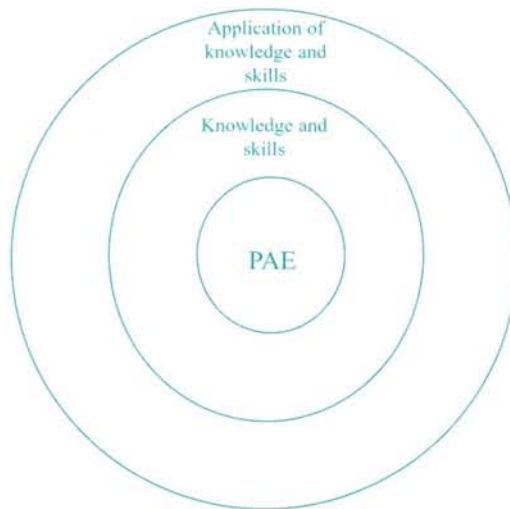
The evidence base that has been used in this section has been created from a range of sources. They include published sources from this country and overseas, 64 assignments written by teachers from London, West Midlands, Shropshire, Lancashire and Sunderland as part of their Certificate in Education, validated by UCE, 48 Foundation teachers from different school settings (unpublished research report for QCA), 60 subject leaders on Inset courses and 37 children aged 7-11 years from different schools, working at an after-school club. There is no suggestion that these form an adequate sample for a major research project; however, it is a sample of opinion from groups of people involved weekly in design and technology in the F&PP. It is an attempt to redress the fact that in the past little attempt has been made to canvas a range of F&PP teachers' opinions, or those of the children undertaking design and technology activity.

Considerations

It is easy to be seduced by the thought that the creation of a new paradigm would ensure the successful rebirth of design and technology. However, careful thought needs to be given to the existing model to ensure that areas that are successful are not discarded, just to create something new.

From the analysis of past practice, the current situation, and the views of teachers and children, the following need to be considered when generating any future paradigm:

Figure 2.



- Start with a paradigm that is appropriate for the F&PP.
- Create a paradigm that is flexible in order that future changes in technologies can be accommodated immediately.
- Build on this, extending and adding areas of experience as appropriate, for secondary and higher education. This should aid the 'bridging the gap' concerns at Year 6/7.
- Ensure that the paradigm reflects 'the importance of design and technology' statement in Curriculum 2000. (DfEE, 1999)
- Build on existing, valuable experiences; do not create something new for the sake of it. When the National Curriculum was first introduced, teachers were urged to build on what existed already, not to discard everything that had gone before. This helped build confidence in the face of so much that was new and untried.
- Address the weaknesses that exist; in particular designing, including product analysis and evaluation, ICT to include control and assessment.
- Ensure that it is appropriate for all F&PP children and that it is sufficiently flexible to allow for real inclusion. It is crucial that it is relevant for children who come from a variety of backgrounds, who live in differing locations, providing environments that offer a range of experiences upon which the children draw.
- Show explicit links between design and technology and other subject areas, in order to clarify how design and technology draws on and uses them.

- Through the new paradigm, ensure that the subject can be moved to the centre of the curriculum.

The paradigm

The main focus of this paradigm is a rearrangement of the existing one to give more importance to particular elements, mainly those that constantly have been identified (OFSTED, 1996, 7, 8, 9, 2000) as weak, and needing development.

The use of three circles to display the three learning experiences of the paradigm mirrors the underlying need to create a model that can be continuously changed to maintain its relevance, without having to take away those parts that are still considered to be important. The circles can be made narrower or wider to reflect the weightings given to each part for the paradigm itself and circles can be added if additional areas need to be added. The heart of design and technology can be shown through the centre circle.

Product analysis and evaluation

At the heart of the paradigm is product analysis and evaluation (PAE). This is carried out to some extent at present through IDEAs activities. Talking with the children in small discussion groups, they responded that one of the most helpful activities that they undertook was the investigation and evaluation of products. Through this they gained knowledge, including information about materials, how the product was made, who it was for, why it was made in the way it was, and sometimes something about the people or company that made the product. They then used the knowledge gained when designing and making their own product. Talking with the teachers, a significant percentage (74% of primary teachers and 79% of foundation teachers) indicated that these activities were either marginalized so 'we can get on with the making' or missed out. From both questionnaires and through discussion, 83% overall felt that if they were more confident about the nature of the activities, these would prove useful in supporting designing. Indeed, teachers who engaged in such activities on Inset courses, analysed the knowledge they gained and found that for them it was critical when engaging in their design and make task.

Knowledge and skills

The next circle contains the area that now relates to the Focused Practical Task. From a study of products, it will become evident that certain areas of knowledge and skills will be needed if the children are to be successful in their own designing and making. This area builds on the knowledge and skills that the children have gained through PAE. These are

areas that should be covered over the F&PPs to provide children with a core of design and technological knowledge and skills that change frequently as new technologies are developed.

Application of knowledge and skills

This relates closely to the design and make assignment. It is the area that allows the children to use their experiences as a basis for their own creations. By placing PAE at the heart of previous activities, it is anticipated that children will now have a better understanding of the products and systems that they are creating. It is also the area that allows the children to be creative and innovative, to work together and on their own, to create products and systems that excite them and allow them to take ownership of their own learning.

In Andy Breckon's paper (Breckon, 2001a), he identifies a separate area focusing on innovation in design. He suggests that it would allow children to have more freedom, 'where they are not always constrained by how they would make a product, or the constraints of the materials that are available'. However, I would argue that giving children total freedom to create anything from anything does not necessarily produce innovation and creativity. From an examination of the teachers' assignments in which they had to plan, carry out and evaluate a unit of work, it was obvious that the children were being creative and innovative, using the materials and knowledge and skills that were available to them. By creating this area, it could result in activities that are set in isolation, not in a relevant context; less confident teachers may focus on this area, asking children to draw an imaginary product, and then not be able to develop the activity, for example, by talking about the materials, purpose, and the way it works. At worst, it might quickly become a 'filling in' activity. Certainly there is a need to focus on creativity and innovation – two words that are missing from the current National Curriculum Programmes of Study, but, I would suggest, this should be done through PAE.

PAE – the content

The content of PAE needs to be made explicit and extended and should be carried out in relation to the products that the children are investigating:

- investigation of materials and components
- need
- purpose
- construction
- function
- aesthetic features

- values, to include environmental and economic issues
- products and systems in relation to times past
- products and systems in relation to a range of cultures
- links with local business and industry.

A new area to be included in PAE would relate to technology and society. Children should learn about the influence of technology on history, including those who have played an important part in shaping the environment, and the role of society in the development and use of technology. This should be closely linked to history and geography and would enrich all three areas. At the present time, children learn little about the range of inventions and innovations that have helped to shape the world in which we live, nor the people that created them. The children should be given opportunities to engage with local designers and manufacturers who play an important part in local communities to help children to understand that people who innovate and invent are everywhere. This might help the children to see opportunities for future careers. This is vital if we are to increase the numbers of those coming into design and technology related work. At present, much effort is put into encouraging the 16+ age group, but there are so many missed opportunities with F&PP children. Moreover, links should be made with local businesses and industry in order that the children can learn at first hand about the processes that are involved in, for example, product design and manufacture. At present, this aspect is often an optional extra, dependent on a teacher who is willing to make such connections.

Knowledge and skills

This will include:

- natural and synthetic materials and components. This will include food and textiles and allows specific materials to be added or taken away as appropriate.
- structures
- ICT to involve the use of CAD
- control technology to include mechanical, electrical and computer control
- techniques and processes that support making, including aesthetics
- technical vocabulary
- health and safety, as it relates to their own activities, including the ability to make risk assessments.

The application of knowledge and skills

This will include:

- Social skills – Children should have opportunities to work in teams, developing their ability to support and listen to each other's ideas. They should have opportunities to communicate with each other and others using a variety of media. This might include interviewing, letter writing and giving presentations.
- Designing skills – Certainly there needs to be a greater focus here on the use of ICT. At present, some argue, including the teachers involved in the research, that using, for example, CAD, the Internet, and CD ROMs to aid designing including communication skills was not practical or appropriate. However, the increasing use of ICT in our everyday lives cannot be questioned and we need to prepare children for the world of tomorrow. Every school may not have the facilities at the present time, but this is changing rapidly and we cannot exclude its use because some have not the facilities. Of the children interviewed, only 1% at present said they had used CAD in any form, or control technology; nevertheless all were enthusiastic to try. Children can be encouraged to use ICT to be creative and innovative in ways that might otherwise not be possible. However, other methods such as modelling with a range of materials, discussion, and drawing should be encouraged alongside the use of ICT.
- Making skills – these are skills that the children will need to make their products and will include, measuring, marking, cutting out, assembling and finishing using tools as appropriate.

Within both designing and making, reference needs to be made to encouraging and developing the children's creativity and innovation skills.

Andy Breckon (Breckon, 2001a) included energy as an element of knowledge that should be included and it was part of an earlier National Curriculum for both science and design and technology at Key Stage 1 and 2. However, it is an area of which children gain knowledge through activities that they undertake. There is already much content to be covered and the teaching of energy as a specific area of knowledge could be left to the secondary stage. This does not prevent children finding out about it on a need to know basis.

Content has been outlined in detail for each area of the paradigm. To make it easier to

access, it could be arranged under the following headings:

- Product analysis and evaluation
- Knowledge and understanding of materials, components, structures and control
- Application of knowledge and skills.

Assessment

If changes are to be made to the paradigm and the content, then the assessment of design and technology may need to change. The teachers interviewed were positive about the use of one attainment target and assessing children using a holistic statement. At present, children are only assessed in relation to process skills, and not for knowledge and understanding, their creativity and their ability to work with others. Whilst the notion of one holistic statement is attractive, it may be necessary to have an additional strand that takes account of the areas at present not assessed. Alternatively, statements can be added to the present system to continue the holistic approach to the assessment of design and technology. It is the latter proposal that I would support.

Support for implementation of a new paradigm

All the teachers involved in the research, without exception, stated that if changes were to be made then support needed to be provided at the same time, not at a later date as previously has happened. A significant minority (43%) indicated that they believed that changes should be made if they provided a better, up-to-date and more appropriate experience for the children. They recognised that in a subject such as design and technology, changes were inevitable as technology is developing all the time.

If design and technology is to move to the centre of the curriculum, then support for planning needs to be provided to show how specific and real links can be made across the curriculum. Teachers need to see what it is that makes design and technology central and how this can be achieved. At the Foundation stage, materials outlining the nature of design and technology, how the subject fits into all six areas of learning and how PAE can be developed will be crucial to give the children the firm foundation on which to build through the primary phase. If PAE is to move to be central to any design and technology activity, then more exemplar materials are needed to indicate how this can be carried out effectively. If the use of ICT is to increase and be integrated into many more of the activities, appropriate hardware and software needs to be provided, together with training.

The way forward

This paper is not intended to present a definitive model for the future. Past and present models have been reviewed and possible future considerations have been included. To achieve a move forward, and not sideways, we need to:

- have further debate to ensure that any new paradigm is appropriate for the present and the future
- ensure that teachers know it is building on but includes some important changes
- fund substantial Inset programmes throughout England – the introduction of the numeracy and literacy strategy and the Exemplar scheme of work (QCA, 1998) have shown that change can be brought in, in a relatively short period of time.
- produce support materials before any changes are to take place
- provide hardware and software for all F&PP schools to enable them to develop the use of ICT particularly in the areas of communication and control
- provide specific materials to support PAE
- to ensure success, there is a need to present the changes in a positive way to show how they can offer children more appropriate opportunities and to offer teachers the support they need to implement change before it happens.

Whilst I believe that the suggestions made are an appropriate way forward, the paper will have failed if it does not produce debate, dissension and agreement amongst those in the design and technology community. The deliberate focus on F&PP education is to indicate the importance of these years in the development of young people who will have the enthusiasm and necessary skills and knowledge to continue to study and use the subject through their lives. This is a concept that is all too often misunderstood. Change in design and technology is inevitable and necessary; the community needs to ensure that the subject is really relevant to the needs of today and the future.

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Glossary

- Foundation stage is for those children aged 3-5 years, taught in a variety of settings
- Key Stage 1 is for children aged 5-7 years and includes Year 1 and Year 2
- Key Stage 2 is for children aged 7-11 years and includes Year 3, Year 4, Year 5, Year 6