

Primary Design and Technology for the 21st Century: The Maurice Brown Memorial Lecture

Introduction

It seems particularly appropriate to focus at this time on primary design and technology education. Very often primary issues are addressed last but as we move into the review of the National Curriculum we need to begin with primary issues before we can move forward and build on these in secondary and further education. It should not be a case of working backwards but of starting at the beginning and travelling forwards. How can we address, for example, such important issues as continuity and progression if we start with a finishing point and build steps backwards? There is surely the great danger of ending up with huge gaps that are difficult to bridge or steps so small that it is almost impossible to build in progression

I want to celebrate the first seven years of the subject in the primary curriculum and to identify some key considerations for the next seven years to show why design and technology is first among equals. Interesting parallels can be drawn with both the story of Joseph and the seven years of plenty, followed by the seven lean years and that of the sower and the reaper. I would suggest that the 'story' of design and technology has been reversed and that there have been seven lean years when seeds have been sown to be reaped in the following seven years. There have been many setbacks at times, including the lack of sun and warmth (little attention given to the value of design and technology and its many successes), too much rain (the continual focus on the negative to 'dampen' enthusiasm), the lack of speed in the provision of support for growth (initial tardiness in in-service provision and publications) and seed falling on stony ground (an unwillingness by some to listen to and accept evidence). However, despite the setbacks, sufficient seed has fallen on fruitful ground and we can look forward to the next seven years of plenty.

The first seven years – the state of the nation

Whilst it is often unproductive to dwell too much on the past, it is important especially at critical times, to reflect on the developments that have taken place, the status quo, before moving forward again.

1. Leading the world

I make no apology for starting the review with what I consider to be the greatest achievement to date – that of leading the world in the development of primary design and technology. Certainly in the last five years this has become apparent through research findings, dissemination of curriculum development projects and after discussion with colleagues, visits to schools and Initial Teacher Education Faculties both in this country and overseas. Our Faculty, along with those from numerous others specialising in primary design and technology education, hosts many visits every year from educators worldwide who are studying the developments in this country. Moreover at the first International Primary Design and Technology conference, hosted by the Centre for Research into Primary Technology in July 1997, our leadership position in the world was confirmed. Nineteen countries were represented and whilst all were at varying stages of developing and implementing the subject, we were leading the way in many aspects. I am not for one moment suggesting that we 'have it all right', that therefore we should be complacent or indeed that we cannot learn from the developments around the world but that we have so much more in place successfully than others. What were the aspects that identified us as world leaders? Conference participants commented on our well structured curriculum, the excellent practice in the Early Years, the in-service opportunities, the enthusiasm of the children and teachers, the range of resources which are available and the clearly identified skills, knowledge, attitudes and values which are developed through design and technology activity. Whilst there was much to reflect upon, three points remain in the forefront of my mind.

Firstly, there were numerous comments relating to the enthusiasm of the teachers and children for design and technology. Participants visited six different schools and also met with teachers who were presenting case studies. None of the teachers involved had a long established background in design and technology education. Indeed, most of the coordinators involved had found the post of responsibility thrust upon them. But almost every teacher in every school was enthusiastic about the benefits derived from engaging children in design and technology

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education. Certainly all the children were excited, involved and able to discuss their projects with the visitors. I listened to four and five year olds discussing the design of their playgrounds, the safety factors which they considered, the idea that no adults should be permitted into the play area and the way in which different pieces of play equipment moved. Other children were quick to respond to questions about the cakes they had created for another class to take home. They identified favourite flavourings, ways in which the mixture had been made and the care that they had taken when preparing themselves for the baking element of the activity. These findings are supported by the 1994-5 Ofsted 'Subjects and Standards Key Stage 1 & 2' document where design and technology was the only subject about which inspectors commented that "pupils are almost always enthusiastic about design and technology and find the work enjoyable and interesting." Talk with any provider of INSET and it is almost certain that they will support the notion of enthusiastic teachers and children. When disaffected children and truancy are problems within the education system today, surely it is important that a subject that motivates and enthuses continues to be developed.

Secondly, there was the passionate belief of all participants, but particularly those from the Pacific rim countries of Japan and Taiwan and from the West Indies, that design and technology education was of crucial importance. Indeed it was this aspect which was highlighted by a BBC news item relating to the conference. Whilst some are looking to the Pacific rim countries to see how they deliver the mathematics curriculum, their educators are investigating the way in which we plan and deliver design and technology in our primary schools. The development of children's language and communication skills, their ability to work independently and in teams, to think critically, to be creative and to use and synthesise knowledge and skills effectively to produce a quality product were identified as key values.

Finally there was the evidence that children who have low self-esteem or who have learning difficulties in other areas of the curriculum often have success when engaged in design and technology activity.

The presentation from a teacher involved with children with severe learning difficulties was of particular interest. These children had been given the opportunity to work in a context that interests them and to develop and use a range of appropriate skills and knowledge within it. Motivation to achieve is created when, for example, there is a need to measure accurately and to cost economically in order to make a quality product, to write a letter as part of research or to discuss with, and listen to, others as they create a design or evaluate a product.

2. The primary design and technology curriculum

Now we have a curriculum that is certainly workable, has value and is accessible to teachers. Consider briefly the relentless changes that took place in the first five years following the introduction of design and technology. Whilst the subject was not new, in the sense that much had been going on for years supported by organisations such as the Design Council, it was new as an entitlement for all children, and therefore a subject which needed to be taught in all state primary schools. Indeed, we were the first country in the world to have such an extensive primary design and technology curriculum as a legal requirement. Our primary colleagues overseas watched in disbelief as our teachers got to grips with one document after another (not to forget 8 other subject documents), too 'folder-shocked' to resist and were then accused of implementing the curriculum slowly. However there is now much admiration that we survived and that a manageable and appropriate curriculum has evolved. It says much about the belief in, and value of, the subject. We now have a structure that is sufficiently flexible to enable each school to provide its children with a curriculum relevant to their needs. The framework provided by the different types of activities – focused practical tasks (FPTs), investigative, disassembly and evaluative activities (IDEAs) and design and make assignments (DMAs) – certainly has helped many teachers to see how to structure their programmes of work. The idea of teaching skills and knowledge has always been implicit, but it is now explicit and has dispelled the myth (which has often provoked unfavourable reactions to the subject) that children should be given

unlimited resources and left to their own devices to design and make a quality product. There is debate about the amount of content within the programmes of study and if coverage of it is a realistic expectation at both key stages. The programmes of study have been carefully constructed so that children can gain skills and knowledge and understanding of certain main concepts through the use of well-chosen examples. I would argue that it is quite possible and that the main barrier to creating a manageable programme is the person who creates the scheme of work.

3. Initial Teacher Education

The introduction of design and technology into the primary curriculum meant that Initial Teacher Education courses had to respond quickly, providing courses for those about to leave as well as for those who were starting. Inevitably, it took time to introduce these programmes and in the early years some students will have left with little to support their classroom practice. Last year the Design and Technology Association (DATA) produced useful guidance, supported by the Teacher Training Agency (TTA), relating to the competences that are required for newly qualified and practising teachers. At the time of writing this lecture, we are awaiting further clarification from the TTA but the general principle of a minimum entitlement for all students is to be welcomed in order that they are able to deliver quality sessions in the classroom (check). Different approaches and strategies are used on different courses and sharing this good practice is crucial. The DATA primary ITE conference in January 1996 provided one such opportunity. Examples that were discussed included:

the use of process diaries which are kept by students to help them to reflect on the development of their own knowledge and understanding

the undertaking of one major assignment by students from which key issues are drawn

the opportunities that students are given to engage in a series of FPTs and IDEAs to help them to develop their understanding of the subject as well as their practical capability.

At my Institution we found initially that many students, particularly our Primary PGCE students, were not able to gain experience of teaching design and technology on teaching practice. Models of good practice offer students opportunities to develop their own understanding of the subject, their practical capability and their understanding of how design and technology can be implemented in a classroom. Some schools were only beginning to teach the subject, whilst for others it was not a focus during the practice. To overcome this problem, over the last five years we have created a PGCE course that involves both students and teachers and has evolved through constant evaluation. Both attend a short taught course, covering the main elements which are needed to be able to deliver design and technology in the classroom; then the students work in school with the teachers on design and technology activities. This partnership enables teachers to have INSET and additional support in the classroom, whilst students gain classroom experience and support from experienced teachers.

Whilst majority of primary BA QTS or BEd students have a short course for design and technology, some opt for a specialist course. Certainly not all institutions have such a course but from an informal survey of colleagues this autumn, there did not appear to be the problems of under-recruitment which some of our secondary colleagues have faced. Students from such courses are well placed to become the coordinators of the future and for some this comes more quickly than they expect. A number of teachers find themselves in coordinating roles during their NQT year or certainly within the first two or three years of teaching.

4. In-service

In contrast to countries such as South Africa and New Zealand which are putting organised training programmes into place before the introduction of design and technology into the curriculum, in England and Wales in-service slowly developed after the introduction of the subject. It is no wonder that reports indicated that teachers were confused and lacked confidence about what and how design and technology should be taught. Eventually, money was found for long award bearing courses through Grants for Education and Training (GEST) funding

and 'Twenty Day' courses were offered through many Local Education Authorities (LEAs). This sent a very positive message to primary educators that at last money was being identified for primary in-service rather than for secondary, as often had been the case in the past. In addition, primary teachers are able to gain a postgraduate or post-experience certificate or diploma after completing many of these courses together with the associated assignments. The in-service opportunities have proved very popular and are successful. A conference for GEST course providers, held at Warwick University in 1994, enabled participants to share experiences, make comparisons and discuss and review course content. No other country provides such award bearing courses for primary teachers, which allow in-depth study of a range of aspects of design and technology. Unfortunately, a recent decrease in funding has led to many courses being shortened to ten and five days and the future for these courses looks bleak.

There has been no large-scale evaluation as to the benefits of such courses but I, together with colleagues, have carried out a small-scale research project with the participants. We investigated the teachers' perception of change to themselves, to some colleagues and to the whole school. There appeared to be little doubt that individual participants found the courses valuable and identified many positive changes to their understanding and practice. Overall confidence had increased in all participants and, certainly by the end of the course, tutors noted that almost without exception the participants were very enthusiastic, wanted to deliver a quality experience to their own children and encouraged others in their schools to do the same. However, after a year to eighteen months, little change in practice and understanding was noted amongst some (less than 50%) of their colleagues and even less to the whole school. Many will not be surprised to learn that after the course, the main barriers to bringing about change were identified as the lack of support of the head and the lack of structured opportunities on the participants' return to school to deliver in-service to staff to address their needs for development. Findings from a follow-up survey with more recent cohorts undertaken last year

suggested that, whilst a similar pattern relating to perceptions of change still existed, greater positive changes had occurred with other colleagues and with the whole staff than the first survey had indicated. A variety of reasons may exist for this, including an increase in all teachers' level of understanding of design and technology and the realisation of the importance and value of the subject. Certainly there was an overall increase of support from the head in comparison to the previous survey.

Other in-service opportunities exist around the country offered by a variety of providers. There are individual consultants, Higher Education lecturers and LEA advisory teachers who offer evening, half day and day sessions which address a variety of needs.

5. Support

What support other than in-service has been available to teachers and teacher trainers to help them to deliver a quality curriculum? Again, little was available as the subject was introduced but gradually support was offered on a number of fronts. Bodies such as the National Curriculum Council (NCC) and Schools' Curriculum and Assessment Authority (SCAA) have produced materials, including non-statutory guidance and Standard Assessment Tasks, which provided ideas for the implementation and assessment of design and technology. As National Curriculum documents came and went publishers were sometimes reticent about producing materials but there is now a range of publications to provide for those at varying levels of expertise.

Suppliers of consumable materials have also played an important role in providing appropriate, quality components at affordable prices. What is just as important is the time taken by leading companies to find out about the nature of the subject, the management of it in the classroom and the ways in which they can best support coordinators and classroom teachers. It has not been just a matter of selling a product.

Business and industry have also played a supporting role in a variety of ways. In addition to sponsorship, printed materials

have been produced; projects such as Technology Tree are running; and teachers and children are invited to visit a variety of placements to gain experience of the world of work. The Nuffield project has recently got under way – the first such project for primary – and we look forward to the material which will be generated and disseminated from it.

Both schools and Initial Teacher Training currently have HMI's with special responsibility for design and technology who are very supportive and approachable. Both have a clear understanding of the important primary issues and a strong belief in the importance of design and technology and they continually offer guidance and indicate standards to ensure the increasing quality of practice provided by teachers and trainers. The Department for Education and Employment (DfEE) has offered support and sponsorship. Last, but certainly not least, a national organisation – DATA – was created and has done much to raise the profile of primary design and technology. The primary advisory group within the organisation is concerned with identifying current issues and future developments that need to be addressed and has created a series of publications which build on each other and support the implementation of design and technology in the primary classroom.

I have identified the hurdles which needed to be jumped as the first seven years have come and gone. Slow responses to the need for finance, for in-service provision, for course development and for support materials were barriers to early, rapid success. After seven lean years, despite these factors, we lead the world. What can seven years of plenty do for us?

The future – seven years of plenty?

With the review of the National Curriculum starting in earnest this year, it will be crucial for all those engaged in primary design and technology to work towards creating a situation which will take us forward into the next millennium to help us maintain our position as first in the world. What then are the key issues and recommendations for the future?

1. World leader

Firstly, if we are to maintain our position as a world leader, we must continue to value design and technology as a subject in the primary curriculum. Ours is a real achievement and one that has been made against many, if not all the odds. At a time when numerous countries throughout the world are seeking to introduce the subject into their primary curricula, we can certainly support others and hope that they can learn from our mistakes as well as our successes. Many countries are looking to make large-scale reforms to enable primary children to experience more integrated and flexible curricula. In Japan, school hours are to be cut from 2003 and different teaching and learning methods, such as problem-solving, are being introduced in an effort to change the type of education that the children experience. Educators want to get away from the narrow rote learning methods and curriculum and provide opportunities for children to learn to think for themselves, make decisions and work together to share ideas and solutions. The introduction of design and technology is one way in which they hope to achieve these goals. This may not seem like a major reform by international standards but it is in terms of educational reform in Japan.

In South Africa, there is an expectation that all primary children should, and will, experience technology education. One project in Natal will have trained all teachers and introduced it into the classroom by the year 2005. In Norway from September 1997, through 'Reform 97', teachers have been encouraged to trial new teaching strategies to encourage children to work in teams and to become more responsible for their own learning. By the turn of the century, New Zealand will have established design and technology in their curriculum. There is little doubt that those who understand the subject and are involved with its delivery in the classroom realise the potential for learning through the subject; the important knowledge, understanding, technical and interpersonal skills and attitudes, such as flexibility and perseverance, which are developed through involvement in design and technology activity; and the links that can be made by the children with the world of work for the future. The children of today will be the

citizens of the new century and they will need to understand the made world and to be able to make appropriate changes for a successful future. They need to understand the differences between needs and wants; the notion that what is good for some, may equally be bad for others; the reconciliation of differing viewpoints; and the importance of critical thinking, developed, for example, through constant evaluation of their work.

2. Public awareness and understanding

Public awareness and understanding of the nature and value of the subject in the primary school is still low and this needs to be addressed. It is also a concern of colleagues overseas. Indeed, this was another common theme which emerged from the International primary conference. In the US for example, in states where they are trying to introduce technology into the elementary school, there are exemplar schemes for parental and local community involvement. As the National Standards for Technology Education are being written in the US now, there is much discussion as to the best way to disseminate them to parents and the wider community. Numerous consultation meetings are being set up for a range of audiences to try and educate the whole community about the nature and importance of technology education.

There are still few people who have experienced design and technology in their own primary education or even through that of their children and many are confused over the content. Generally media coverage of achievements has been poor; and at the present time there is an overwhelming emphasis on English and maths. Whilst I would argue that high standards in English and maths are essential, children will need more than this when they leave school for the world of work. Parents and people in the wider community need to understand that design and technology provides opportunities for using and contextualising language and scientific and mathematical knowledge and skills. It was interesting to learn from the Third International Maths and Science Study that English children aged 13 are world leaders in applying maths and science skills to real life situations. This finding merited a small article in the TES but I did not see us celebrating this achievement with wide media coverage.

Perhaps it is the British characteristic of underplaying achievement (if such a characteristic exists) that is to blame. However, we are quick to publicise poor attainment. It is accepted that skills relating to communication, teamwork, the sharing of ideas, critical thinking and creativity are all developed through the subject and they are all very necessary for the children's future. Whilst writing this lecture, I studied job opportunities advertised in a range of newspapers and those were the skills that continually were being requested. How can we address this concern in the future? Opportunities should be taken to publicise, through the media, achievements in school, in ITE and in industry. There is much excellent work that is ongoing that could be shared through articles in journals and newspapers both in this country and overseas. The projects undertaken with, for example, business and industry could be shared not only with other teachers, children and parents but with the employees of the companies involved. Local radio and television could be involved not only in publicising work but also in being involved in projects. The primary advisory group for DATA is producing a leaflet which will be available for distribution to parents, governors and the community to help explain the nature and importance of the subject. Unless people understand what the subject is, it is hard to value it.

3. The curriculum

The key issues here are the importance of design and technology as a separate subject, manageability and appropriateness.

Design and technology has a specific identity, clearly defined in the programmes of study which have evolved over the last seven years. We have evidence of previous confusion when the subject was put with science and then included with IT in the 1990 document. In other countries where science and technology have been joined there is not only evidence of confusion amongst the teachers but confusion in planning appropriate experiences for the children. Whilst design and technology does draw on bodies of knowledge from, for example, science, it is a unique subject and should remain so.

We must examine the curriculum to ensure that it is manageable, relevant and will provide opportunities for the children to develop skills, knowledge and understanding that can be built upon during their secondary education and beyond. Design and technology is in a different position to the other National Curriculum subjects in that it has already undergone major reviews since its introduction in 1990. All those involved in the subject have been engaged in debate and the curriculum that we have now is appropriate for all primary aged children. It does provide opportunities for children to develop their practical capability, their knowledge and understanding of the made world and skills which are important in life-long learning. A study of the Desirable Outcomes shows that much of the early years curriculum can be delivered through design and technology. Areas such as personal, social, physical and creative development, together with mathematics and language and literacy can be introduced and reinforced through design and technology activity. To deny children at Key Stage 1 or 2 a minimum entitlement to these activities would be a retrograde step and one which many would argue against. I would argue that what is needed is not a change to the curriculum or its entitlement for all children aged 5-11 years but a focus, an emphasis, on certain aspects which are less well developed than others.

Firstly, we need to ensure that curriculum planners do not plan too much for design and technology. I would argue that there is not too much content in the programmes of study; it is the way that they are interpreted by some that can cause an overloaded curriculum. In my own experience, some coordinators feel that they have to include a very wide range of concepts and skills rather than take the main concepts and skills and use a few examples to help children's understanding. The coverage of a very wide range of concepts often leads to incomplete schemes of work, unfinished products and frustrated teachers and children.

Secondly, we know from Ofsted reports that children's design work needs attention and my own observations and discussion with colleagues would support this. There is still a very narrow view of the nature of design and frequently children are asked to draw a

picture of what they want to make without being given opportunities, for example, to research using a variety of sources, to develop drawing skills, to examine a range of made products, to disassemble them to gain an understanding of how they work, to investigate the properties of the materials that have been used and how the parts have been assembled.

The ability to evaluate, not only their own work and products but also those of others, is a third area that needs to be developed. When discussing a made product with children, it is important to use a variety of open questions that allow them to consider for example its purpose, appearance, form, value and function. We have the opportunity to encourage children to question values – their own as well as those of others – and to begin to develop an understanding that not all people have the same values and the values that others hold are not necessarily better or worse than their own. We 'lost' the phrase 'from other cultures' during one of the reviews, which I felt was unfortunate. Whilst there is much evidence of classroom-based work linked to a range of cultures, it can be overlooked as it is not explicit within the programmes of study. When evaluating the product that the children have made themselves, there is still evidence that many are asked a limited number of questions such as 'Do you like it?' or 'How could you make it better?' I always imagine someone asking me that question after struggling all day to make something that works. I am sure that I would not be as polite as the children who write, "Yes" and "I couldn't". More emphasis needs to be placed on helping children to set criteria at the beginning of an assignment so that at the end of the assignment, the children have something against which they can evaluate their product. It is then that they can begin to tease out the strengths and areas for development. As the children work through an assignment they have a framework within which to work and can continually go back to the original criteria upon which they have decided. Moreover, it is more likely that the children will have success as they have a clearer understanding of what it is they are trying to achieve.

Finally, as we move into the twenty-first century, I would suggest that we need to be

sufficiently flexible to take into account possible future developments and to be able to respond rapidly to these. At the present time, children are given opportunities to work in a range of contexts with a wide variety of materials and tools but this may become limiting as new technologies are developed. Constant evaluation and research will identify these new developments, which can be translated into practice through a structured programme of INSET.

4. Implementation of the curriculum

Over the last seven years standards of teaching and learning have been rising and we need to build on the best practice which has been identified. In the 1995-6 Chief Inspector's report, based on Ofsted findings, there is evidence of significant improvements in the quality of teaching in primary schools, particularly in the early years and again at the end of Key Stage 2. Where teachers have been supported by in-service training, have confidence in their own knowledge and ability to teach the subject and have access to support materials and adequate resources, examples of good practice can be found. High standards in children's learning are characterised when they regularly develop products to meet simple specifications, make products using tools and materials which they have selected and test and evaluate products, including those which they have made themselves.

A study of effective teaching and learning strategies in design and technology needs to be made. Educators such as Froebel, Montessori and Steiner believed in the holistic nature of children's learning and the importance of developing self discipline, autonomy and intrinsic motivation through hands-on activity which allow children opportunities to make their own choices. Through Piaget's and Vygotsky's work it has been argued that activity forms the basis for learning and for the development of thinking skills. Young children, as active learners, need new experiences to stimulate and motivate, though they still need to feel in control of their classroom environment. It is important that we never underestimate the capabilities of young children, their ability to grasp new concepts, to acquire new technical vocabulary and to make decisions and choices for themselves. Robert Fisher

supports this notion and argues that we need to present new ideas and information as problems to be solved or areas to be investigated.

5. Cross-curricular links

The review needs to consider and clearly identify the relevant cross-curricular links that should be further developed through design and technology activity, particularly with English, mathematics, science, ICT and art. This would certainly aid the delivery of all the required content through a more effective use of time. It is a common theme that design and technology is a suitable context for developing mathematical and English knowledge and skills but in my experience these links are often missed in reality. We now have the useful leaflet from SCAA 'Design and Technology and the use of language' which, if used effectively, will help identify ways in which both design and technology and language can be enhanced. Certainly I recognise the importance of language, but also I realise that it cannot be developed in isolation; it needs contexts. Surely with the emphasis that now is being placed on literacy and in particular reading it is crucial that explicit links between subjects are made when planning. Children need contexts in which they can talk to help clarify ideas and extend their understanding. Indeed, Bruner showed the importance of language in helping children to develop knowledge and understanding in the context in which they are working. When researching for ideas, children will have the opportunity to read, to skim and scan a variety of books. Writing for a variety of audiences can be developed through writing notes, writing letters, evaluations and analysis of data from for example, questionnaires. In the past children have been engaged in this type of activity, but with the increasing need for accountability, the links in activities need to be shown in planning. The same argument exists for mathematics, though evidence drawn from the 1995-6 Chief Inspector's report shows that too few schools make use of opportunities to develop and reinforce mathematical skills. Whilst there is an obvious need for separate activities for mathematics, it is essential that children are given opportunities to apply their mathematical understanding and skills in a range of contexts. A study of the use and

application of the mathematics strand of the National Curriculum together with the framework for the Numeracy project shows opportunities for applying and reinforcing concepts relating to, for example, measurement, shape and handling and interpreting numerical data. One project in which I was involved included eight classes of Y5 children who had to measure wood accurately for their assignment. The class teachers were very surprised at the children's lack of accuracy as in maths lessons they were able to draw and measure lines in books. However, on reflection the children had had little experience of applying this activity in other contexts. The use of different rulers and the need to calculate the different lengths of wood to make a cube proved too difficult for many. But it is the opportunity to use knowledge and skills in such situations which is so important for the children's future lives. The same applies to science, ICT and art. There are many natural links but these are not always indicated in planning. With the Government's plan to focus on ICT, there should be many opportunities for children to use programs, CD-ROMs, the Internet and E-mail for research, but careful planning will be needed to ensure that these are used effectively. Now teachers are gaining in confidence with the content of the curricula, it should be easier and seen as desirable that the links are identified.

6. Initial Teacher Education

Just as the Standards for the Award of Qualified Teacher Status have implications for design and technology in ITE courses, so too will the National Curriculum review have an effect. It will be essential that all institutions that offer the subject are able to give students sufficient support, including appropriate time allocations. The present indications are that design and technology will be one area for which primary ITE can bid for extra numbers. Certainly the TTA have identified it as an important area, recognised the shortage of qualified teachers and have acted to try to solve the problem. I am certain that the use of ICT will expand and support independent learning. Whilst students will always need a 'hands-on' element to their course to develop their practical capability, video, slides, CD-ROM, the Internet and video conferencing will be

used by students to develop individual areas of learning and expertise. Nevertheless, it is crucial to remember the importance of the human form in learning, of peer interaction and discussion, not just new technologies.

Another way of covering more in the same amount of time is to identify the cross-curricular links in the students' curriculum in the same way that they are drawn out in school planning. This is not to say that design and technology should or could be subsumed within other subjects but that appropriate links are identified. It is essential that students understand the links between design and technology and other curriculum areas, that they highlight those that are not appropriate, and that staff work together to provide students with a coherent curriculum. If the students of today are not helped to understand the links in ITE, they will be ill prepared for making them in the classroom.

Finally, I am certain that there is still much to be learnt from sharing the good practice that has been, is being, and will be developed. Whilst there are always good reasons for not finding time to take part in such activities (time, cost and distance are just three), I am certain that the value of the information that will be gained will outweigh any problems that need to be overcome.

7. Research

Until recently, research into issues relating to primary design and technology was limited. As a new curriculum area, it had to become established before certain aspects could be explored. There is, for example, research into design related aspects, the use of construction kits and gender but I would hope that over the next seven years more money and energy would be concentrated on research to help the subject to grow and develop through the research findings. A research interest group was set up at the IDATER 1996 conference and it gave a focus for interested people not only to discuss research in which they were engaged, but to debate important issues and identify key areas for future investigation. The work being undertaken at this time by DATA to collate and publicise past and ongoing research should do much to support these future developments. Personally I would hope to see research into

the value of design and technology for young children and the development of language and mathematical skills and knowledge through design and technology in the near future. Research priorities, to include research into the aspects primary design and technology in other countries, need to be established now so that findings can inform future practice.

8. A professional organisation

It is not only in the area of research that DATA can play a key role in supporting the future evolution of the subject. It is vital that there is one independent, professional body through which for example, information, research and curriculum development can be channelled. This is not to say that individuals, organisations, business and industry cannot act independently but that DATA acts as a national conduit through which information is processed and disseminated. The National Framework for supporting design and technology in Primary Schools that is being set up by DATA now will be crucial for supporting the future, all round development of the subject. It will be possible to find out not only what is available and what will be available but also what gaps need filling. Whilst many will benefit from this, I would wish to highlight the importance of this Framework to business and industry. Certainly in the past, less money has been allocated to primary initiatives. Whilst there have been three major secondary projects, it is only last year that a primary project – the Nuffield project – has been given funding. However, there has been a move by some to support primary design and technology including Unilever's sponsorship of the International Primary Conference proceedings and a range of publications by industry, some of which have proved more useful than others. In the future, it will be possible for individual companies to identify gaps, to seek advice through DATA and still to support an event or publication which interests them. It is important for those who may hesitate to fund primary initiatives to understand that research shows that children's interests and values are often set by the age of ten or eleven. They have decided upon areas of study that they enjoy and it is almost impossible to change these. The primary advisory group for DATA will continue to be proactive in publicising good practice and

initiating new publications to enable the subject to develop. (Two future publications focusing on the early years and INSET provision will certainly fill an important gap.)

9. Support

Continuing support for the implementation of the subject is obviously a priority for the future. In-service, support personnel and resources will play key roles. At the time of writing this lecture, the future of GEST courses seems very uncertain; nor have alternative means of in-service provision been identified. For design and technology to be taught by confident teachers, there has to be a continuation of organised in-service programmes. Lack of adequate teacher knowledge and understanding and the related lack of confidence have been, and still are, critical reasons for the slow development of the subject in some schools. The forthcoming Needs Assessment materials produced by the Northampton Inspection and Advisory Service (NIAS) will be one tool through which teachers can identify their areas of strength and those that need to be developed. The success of the GEST courses cannot be questioned. Ofsted, HMI and the DATA Survey of Provision for Design and Technology in Schools 1997 have all provided evidence of the success of the courses in increasing knowledge, understanding and confidence of teachers. Moreover, it is not only teachers who need further in-service. From the 1997 DATA survey, it is apparent that non-teaching assistants do much to support the delivery of the subject and thus need specialised courses which they can attend. Greater use needs to be made of parents and people in the local community. There will be many who have much to offer through the knowledge and skills they have developed through their everyday work. They need to be encouraged to share these with the children in the projects with which they are involved.

The survey also highlights the importance of the need for cheap, quality resources as many schools lack appropriate ones to be able to deliver the curriculum. The concern relating to the future provision of resources needs to be addressed. The sum of £1.80 per child (the amount determined by the DATA 1997 survey) hardly seems adequate for the provision of books, materials and

equipment to support quality design and technology. Some schools are able to make an appropriate provision and this should be aimed at by all. The annual Design and Technology Education Exhibition provides an annual focal point for all involved in primary design and technology to update themselves with information on the latest, and many suppliers and publishers are constantly updating resources through investigation of needs.

10. Liaison

As teachers of each age phase are coming to an understanding of the content of the curriculum, methods of delivery and assessment, the issue of liaison between age phases needs to be addressed to ensure continuity and progression. Of course, there have been cross-phase projects, both nursery to primary and primary to secondary but there is no evidence to suggest that this is widespread. We already have the work carried out by researchers at Goldsmiths which offers us all a starting point in, for example, examining the effect that different teaching styles in primary and secondary schools have on the delivery of the subject. These differences are especially noticeable at the Key Stage 2/3 divide. The notion of the teacher acting more as a facilitator than an instructor changes at Key Stage 3 to one of tighter teacher control where the teacher directs rather than supports the children. It is important now to start to work towards a holistic view of the development of design and technology capability for pre-school children through to the end of Key Stage 4. I would suggest that this could be a focus for more research as well as in-service work. With all the pressures on teachers' time, individuals whose main concern is for their year group will not see it as a priority. However the provision of specific courses with structured programmes would offer opportunities to teachers from different phases to meet, to debate issues relating to teaching and learning, appropriate assignments and knowledge, understanding and skill development. There would be opportunities for teachers to see and evaluate work from children at different stages of development and to gain a clear picture of what continuity and progression means in practice.

Conclusion

I have tried to set out where we are in terms of primary design and technology today. I

know that colleagues from other countries are envious of the best of our achievements in such a relatively short space of time. It was only two years ago that the first cohort of primary children to have experienced design and technology as a legal entitlement throughout their primary education left Year 6 (aged 11 years) and they will not reach the end of Key Stage 4 until the year 2000. But we know from research into change and its management (and common sense) that legislation is not sufficient on its own to bring about change in practice. It is a process that has to be worked through, and people have to adopt a change and experiment before it is incorporated into their practice. Of course, it is essential that all are involved – not just policy makers and managers, but all classroom teachers and children. We have had no difficulty in winning over the children together with those teachers who have a clear understanding of the subject. Moreover providers of GEST courses will recognise the scenario of enthusiastic participants leaving with a passion for design and technology and recognising its value in the curriculum. However if we are to maintain our position as a world leader we cannot afford to be complacent. We need to ensure that the subject continues as a mandatory subject in the curriculum. At a time when so many countries are introducing it as a compulsory subject, it would be a retrograde step to make it optional. We have evidence to show what happens if we do. There are countries such as the Netherlands where it has been optional and the developments over the years have been minimal and driven by a few enthusiasts. We know that before the National Curriculum, the curriculum entitlement for each child was very much left to individual schools, teachers and their enthusiasms and that many children throughout the country missed out on a broad and balanced curriculum. Now we should look forward to a stable period where teachers, teacher trainers and children can continue to build on the achievements of the last seven years, to have seven years of plenty. It is only then that design and technology can hope to remain first among equals as a subject in the curriculum, as a preparation for the world of work and as a means of providing opportunities for young children to acquire knowledge and understanding to help them both to make sense of the world and to offer ideas for future developments.

This is an edited version of the Maurice Brown Memorial lecture delivered at the 1997 Design and Technology Education Exhibition.