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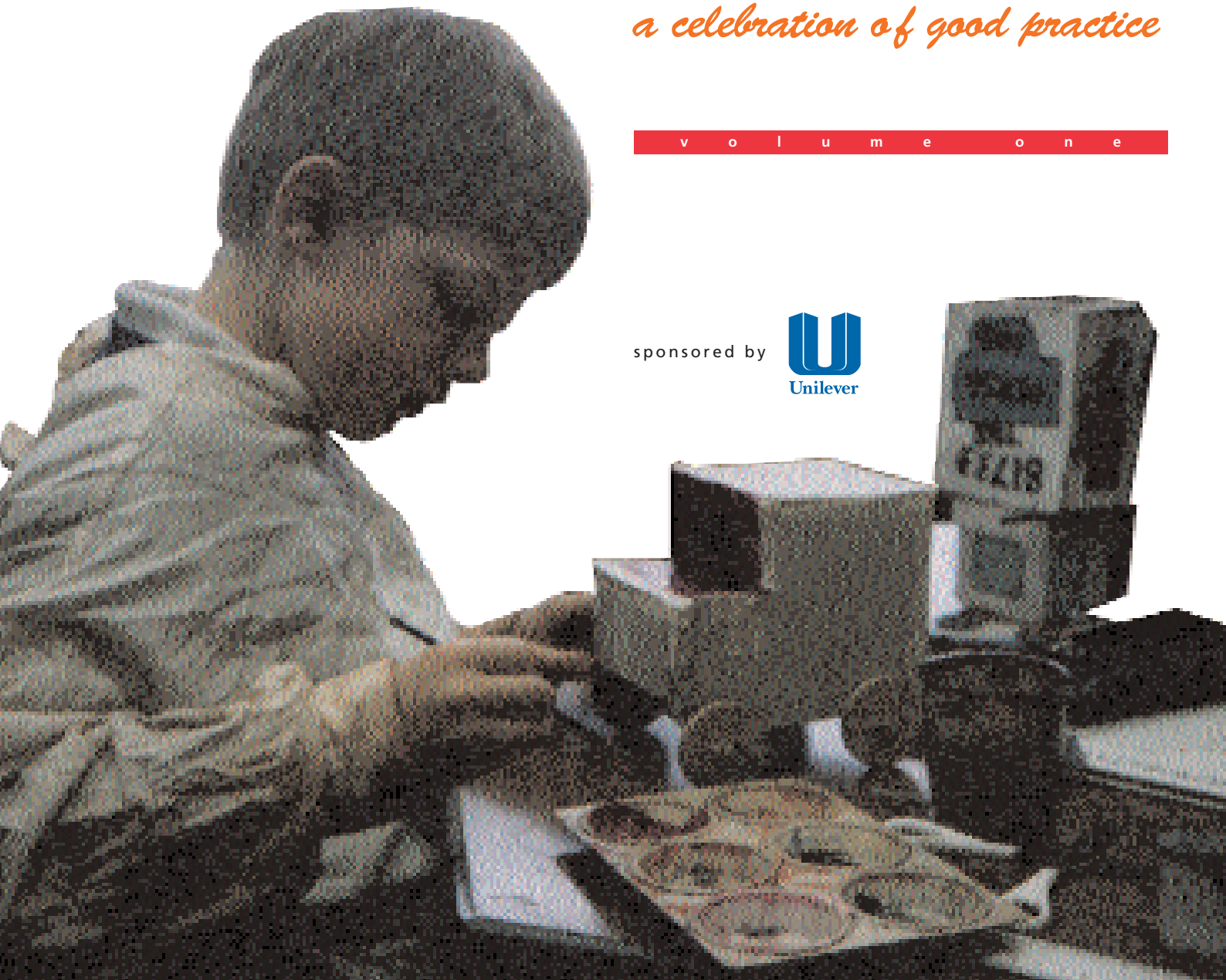
international primary design and technology conference

a celebration of good practice

volume one



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International Primary Design and Technology Conference –
A Celebration of Good Practice

28th June – 2nd July 1997, Birmingham, England

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CENTRE FOR RESEARCH IN PRIMARY TECHNOLOGY

DEDICATION

These conference books are dedicated to Dr. Jan Hendrik Raat of The Netherlands, who inspired many primary educators with his enthusiasm and commitment to the development of primary technology word wide.

Introduction

This publication includes all the papers and case studies which were presented at the first International Primary Design and Technology Conference held at the Chamberlain Hotel in Birmingham from June 28th until July 2nd 1997. It also contains background information on the way in which primary design and technology has developed in this country over the last decade.

Volume One contains material which it is hoped will be of interest to a wide audience of professionals in schools, local education authorities, institutes of higher education, business and industry. Volume Two contains material of a relatively specialised nature and is therefore suitable for more detailed academic study.

This publication is intended to provide a valuable contribution to the literature in this expanding subject in primary education. We hope that you find it both interesting and informative.

Richard Ager / Clare Benson
June 1997

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BACKGROUND PAPER 1

In-service provision for design and technology for primary teachers

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Clare Benson – Director of School of Mathematics, Science and Technology

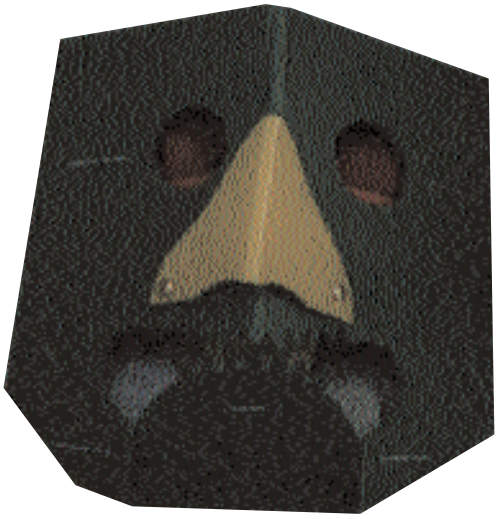
Introduction

Whilst art, design, craft, technology and science have a long history of being a part of the primary curriculum, it was not until 1990 that all primary schools in England and Wales had a legal obligation to deliver design and technology. The National Curriculum programmes of study laid down the content that had to be covered and the statements of attainment (later the level descriptions) provided the assessment framework. This was a new curriculum area for the majority of primary teachers and there was much confusion as to the nature of this subject. Moreover, there was no organised programme of In-service which would have helped teachers to gain an understanding of the knowledge, skills and the ways in which design and technology can be implemented in their schools. The In-service that was offered was varied. It included day and evening courses run by Higher Education Institutions (HEI), independent consultants and Local Education Authorities and few courses were more than a day or two in length. It was not until 1993 that money become available for In-service design and technology courses through the Government funded Grants for Education Support and Training (GEST) In-service programme. Money for mathematics and science had been available since 1990 and these programmes had proved successful. It was now decided to provide twenty day courses for enhancing teachers' subject knowledge in history, geography and design and technology, and a year later changes were made to allow courses from five to twenty days to be created.

The Department for Education (DFE) laid down specifications for the courses, based on findings from a report by Her Majesty's Inspectors (HMI) and an evaluation project of designated mathematics and science courses carried out by Harland and Kinder (1992). A number of features common to effective courses were identified and it was expected that these would be reflected in the course outlines submitted by course providers to the DFE for scrutiny before becoming designated courses to which funding would be attached. These were:

- Attendance – Short blocks of full time study, integrated with school and classroom assignments
- Staffing – Small course team with complementary interests, where tutors demonstrate subject expertise, a familiarity with primary practice and skill and experience in teaching extended courses.
- LEA/HEI partnership – Clear criteria for selecting participants in order to identify those who would benefit most and a course structure designed to meet participants' needs.
- School involvement – Course members were to be found in schools where the curriculum area was identified in school development plans, head teachers were actively supportive and some non-contact time would be given to enable participants to work with other colleagues in school.
- Venue – This should provide adequate resources and a suitable environment in which to work.
- Follow up – Tutors should continue to provide support after the course.
- Main aim – The main aim of the course should be not only to develop teachers' confidence, knowledge, understanding and practical capability but to give attention to the teaching of the subject, including planning and assessment.
- The course content – The course content should link closely to the main aim. It should enable teachers to develop their technological capability, to know how to use a range of materials, equipment and tools, to be able to apply knowledge relating to the programmes of study for Key Stages 1 and 2 (children aged 5-11 years) to develop their approaches to teaching the subject, including planning and assessment, and to gain confidence in their abilities to carry out In-service work in their own schools.
- Selection of participants – Priority should be given to those who have a responsibility for the subject in school, the subject co-ordinator.

In 1994, providers were able to bid for shorter courses – both five and ten days – as well as the longer courses (DFE Circular 10/93). The aims of the shorter courses remained the same but obviously cuts in content had to be made and the depth of provision could not be maintained. The courses have made an impact. From research by Benson et al (1996) and the DATA survey of schools (1996) it is clear that teachers have gained in confidence and that



attendance on the course has helped bring about positive change in their own practice. However from the work of Benson et al (IDATER 1996) and, as yet unpublished follow up research, perceived changes to other colleagues and to the school as a whole are not so great. One of the main conclusions drawn from the research findings is that following the course, an organised programme of In-service in school needs to be developed. The most commonly used dissemination technique was informal discussion in, for example, school corridors and whilst this can be useful it should not be the main method used.

Changes to the funding of the GEST courses may soon be announced as the Teacher Training Agency (TTA) is reviewing In-service provision as part of a whole series of changes relating to the continuing professional development of teachers. Whatever changes are made, it is to be hoped that the courses continue to run as they have contributed to the growing success of the implementation of design and technology in the primary classroom.

Case study

Many institutions and Local Education Authorities provide long award bearing In-service courses in design and technology and this is just one example which indicates the kind of provision that is available in England and Wales.

Since 1990, UCE has provided a range of In-service courses for teachers of design and technology. Provision include evening, half day and day courses covering both the development of teachers' knowledge, understanding and practical capability and the implementation of design and technology in schools. However from 1993 with the Government funding twenty day GEST courses and later five and ten day courses, UCE has worked with five different West Midlands Authorities, Birmingham, Dudley, Walsall, Solihull and Wolverhampton, to provide long award bearing courses.

Obviously these courses are based on the guidelines issued by the DfEE, but they are individualised for the different authorities to meet their needs and priorities. Course tutors work very closely with each Authority and their tutors to ensure that there are common aims and understanding. Teachers are selected by the LEA using a range of criteria but all need to be co-ordinators or have design and technology as an area of interest and all need to have identified it as part of their school development plan. Whilst each course pattern is determined by the LEA, all allow participants time to go back into school and reflect on their practice between blocks of work.

Course participants and their headteachers are invited to a pre-course evening session in order to explain both the expectations of and the rationale for the course. In addition all the practicalities can be explained so that no time is wasted on the first day locating the course venue, parking and that all important cup of coffee. Headteachers are invited as research has shown that to bring about change, the understanding and support of the headteacher is crucial. In the Initiatives in primary science and evaluation report 1988, the Department for Science and National Foundation for Educational Research report on mathematics and science courses 1989, and research by Benson et al (IDATER 1996), teachers identified that on return to school, there was little change and development unless the headteacher was supportive. By involving the headteacher, s/he can understand the commitments which the teacher is taking on together with the assignments which can be undertaken. Teachers are asked to complete an audit as they start the course to enable them to establish both the strengths and the areas for development within their schools. The audit covers the areas of documentation such as policy and schemes of work, practical capability, designing and making skills, and knowledge and understanding of both the participant and the staff in his/her school, classroom organisation and management, implementation of design and technology and resources. This enables the participants to gain a clear picture of the state of design and technology in their schools and to begin to make an action plan for the short, medium and long term. It also provides a focus for individuals in order that they can prioritise what they want from the course.

The first ten days of any of the courses are similar.
The content includes:

- the nature of design and technology
- design and technology and the National Curriculum
- the role of the co-ordinator
- planning and delivering In-service work
- documentation
- resources
- planning, implementing, assessing and managing design and technology

- designing and making skills
- knowledge and understanding
- development of practical capability.

On the first morning, the teachers introduce themselves and outline their school responsibilities and their reasons for coming. This helps to 'break the ice' but more importantly, helps them to identify colleagues with similar priorities and situations. One of the important parts of any course, and this is no exception, is the interaction, discussion and sharing of ideas between colleagues.

Debating the nature of design and technology and examining the National Curriculum gives all the teachers a firm foundation on which the rest of the course is built. It is useful to explore differences of opinion and to raise questions which staff back in school might ask. An outline of a policy is discussed and ways in which to approach whole school planning are suggested. Each teacher is then expected to revise or develop appropriate documentation for his/her school. Time can be taken during the course for this and the tutor is available to help individuals. The role as co-ordinator is explored so that the teachers have a clear understanding of the nature of that role and how they can move forward in their own schools. After the course, the teachers are most likely to provide In-service for their schools and therefore strategies are suggested to help them provide successful sessions. Particular emphasis is placed in discussing and developing an understanding of designing and evaluative skills and how children can develop these skills. (Indeed, the recent Office for Standards in Education (OFSTED) 1997 report highlighted the need to develop children's designing skills).

The teachers' practical capability and knowledge and understanding are developed through a series of practical activities. Different materials are introduced together with the appropriate tools and equipment. A range of joining and finishing techniques are explored. Knowledge and understanding relating to mechanisms, control and structures is gained and developed through taught inputs and support materials. The taught inputs are given at the start of the day and then participants are given the choice between moving on to make teaching aids for their schools, focusing on for example a particular mechanism or spending further time with the tutor developing specific areas of knowledge and understanding in which they lack confidence.

Making can then be undertaken later in the day. The making of teaching aids are an important feature of the course. Not only does this help teachers to understand the problems that can be encountered when children are making in their classrooms, but it provides examples which can be used with both staff and children to help gain an understanding, for example, of a particular mechanism or the use of a particular material.

When addressing the issues which relate to planning, assessment and implementation, the teachers are encouraged to draw on their experiences and to share their successes and areas of concern. Strategies for assessment are drawn out through

assessing a collection of work which the teachers bring in from their schools.

Teachers on a twenty day course move on to a major making project in which they apply the knowledge and understanding and skills which they have gained through focused practical tasks and investigative, disassembly and evaluative activities on the first part of the course. In addition they spend more time on computer control and working with colleagues in school.

As part of the teachers' continuing professional development, it is possible for them to complete assignments which will allow them to gain a Post Experience Certificate in Education The assignments are integral to course and relate for example to planning, policy, schemes of work, their own practical capability and their classroom practice. Whilst it is not a requirement from any LEA that teachers have to do the assignments, they encourage the completion of them and many teachers gain the award.

References

- Benson C, Johnsey R and Wiggins D (1996)
  In-service training for primary design and technology – Is it working?
- Smith J (Ed)
  Proceedings IDATER 96
  Loughborough University, pp.121-128
- DATA (1996)
  Survey of design and technology in schools 1995/6
  Wellesbourne, DATA
- DFE Circular 10/92, including Grant 11
  Designated Courses for Enhancing Primary Teachers' Subject knowledge
  DFE
- Harland J and Kinder K (1992)
  Mathematics and science courses for primary teachers: lessons for the future
  NFER
- Slade J, et al (1988)
  Initiatives in primary science and evaluation
  ASE
- OFSTED (1997)
  Annual Report of Her Majesty's Chief Inspector of Schools
  HMSO

BACKGROUND PAPER 2

Primary ITE Courses in the UK – Developing D&T Education

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Introduction

In 1989, a National Curriculum was introduced into all primary schools in England and Wales. English, mathematics and science were identified as core subjects and were the first three that had to be included in every school's curriculum. Technology (consisting of design and technology and information technology capabilities) was introduced in 1990, followed by history, geography, art, music and physical education. Concern was expressed by many practicing teachers that they had little expertise in science, still less in the 'new' curriculum area of design and technology. Whilst Higher Education Institutions (HEI) and Local Education Authorities (LEA), through their advisory teacher services, developed a variety of support mechanisms for existing teachers, it was obvious that rapid changes needed to be made to primary Initial Teacher Education (ITE) courses to ensure that newly qualified teachers were able to incorporate successfully into their teaching programmes the National Curriculum for design and technology. A report was produced by the Council for the Accreditation of Teacher Education (CATE), which stated that by January 1990, all primary courses should include a 100 hours for Science and Technology. It was a mistake to link the subjects, a mistake, it can be argued, which continually held back the development of design and technology courses. Institutions responded in differing ways and at differing speeds, and as it was the only subject area that was new to the primary curriculum, design and technology education proved to be a special case. It was not appropriate to restructure courses, as none existed. New ITE courses had to be developed. At the present time students can gain experience of design and technology in a variety of ways. Institutions run both three and four year courses for education. During their course students can take design and technology as a focus for their degree. This can be as one main subject, as a main subject together with a minor subject, as one of two main subjects or as a minor subject. For those students who are not majoring in design and technology, most institutions provide a short course which covers the basic national requirements and gives them opportunities to develop their own knowledge and understanding and practical capability. From discussions held at the Design and Technology Association (DATA) Conference for ITE in Normanton, Yorkshire, January 1996 it became apparent that institutions have very different time allocations for this part of the course, mainly between five and forty hours for each student.

Before the implementation of any of these courses, various considerations had to be taken into account when planning took place.

Staff expertise

As design and technology was a new subject area, many institutions had few if any staff with expertise in this area and no additional Government funding was made available for staff training or new staff appointments. Some institutions were able to draw on the expertise of colleagues who were already delivering degree courses in design, technology, science and other related areas; some were able to make new appointments and/or second advisory teachers and teachers from the classroom; some created programmes which drew on the expertise of existing staff in related areas, such as science, art and mathematics; whilst a few institutions failed to respond to the need for new courses until very recently.

Time allocation within primary training courses

Whilst English, mathematics and science and technology initially had to have an allocation of 100 hours each and, more recently 150 hours, no specific time allocation was made for design and technology. Some institutions have a standard time allocation for all professional work in all foundation subjects, whilst at others time allocation is left to the discretion of course organisers.

Resources

No additional Government funding was made available for resources and therefore, it was left to individual institutions as to how the new courses were to be resourced. Again, some found specific funding from within existing budgets; some resourced courses through allocations from other subjects such as science and art; whilst others responded by mainly ignoring the issue and providing little.

Course content

Unlike schools, there was no National Curriculum for ITE courses and therefore each institution was required to devise its own. More recently, a framework has been provided by the introduction of competences which all students have to achieve, outlined in the circular 14/93. This circular takes into account a variety of research including the report by Alexander et al (1992) and the OFSTED report on classroom organisation and classroom practice (1993). However, specific content is not identified, just the notion that all students need to be able to teach National Curriculum subjects. More recently, different models for courses have been proposed, including the introduction of a three year B.Ed to prepare primary teachers to work across the curriculum (14/93). Here, the notion of a 6 subject degree is suggested, but again, no specific content is given. In 1997 a consultation document from the Teacher Training Agency (TTA) has been circulated in which a National Curriculum for mathematics and English is outlined. Whilst it is intended that there will be a National Curriculum for science, there are no plans yet to devise such documents for other subjects. Having a National Curriculum for design and technology would give all institutions a common framework within which to work and would ensure that students have a minimum entitlement to that subject.

Case study

At the University of Central England (UCE), in the Faculty of Education, a decision was made that there would be three courses relating to design and technology. Firstly, all students on the four year BA with Qualified Teacher Status (QTS) have a minimum entitlement to 25 hours of design and technology as a discrete subject. In addition, students on this course can also opt to take Studies in Technology (equivalent to 1 year of their 4 year course) as their specialist degree subject and thirdly, the Post Graduate Certificate in Education (PGCE) has a minimum entitlement of 25 hours design and technology. Changes have been made since 1990 and, as a new 4 year BA with QTS will be introduced in October 1997, are about to be made again in a continuous effort to ensure quality courses for all students. The course time is divided between workshops and lectures, directed tasks, private study time and assessments.

Design and Technology for all B.A (QTS) students

Although there are many links drawn to other parts of the course over the four years, at present this course consists of 25 hours of discrete design and technology and a separate allocation is given for assessment. Links between mathematics, science and art, English and teaching studies are continuously highlighted and discussions with staff in these subjects areas are held during course planning sessions.

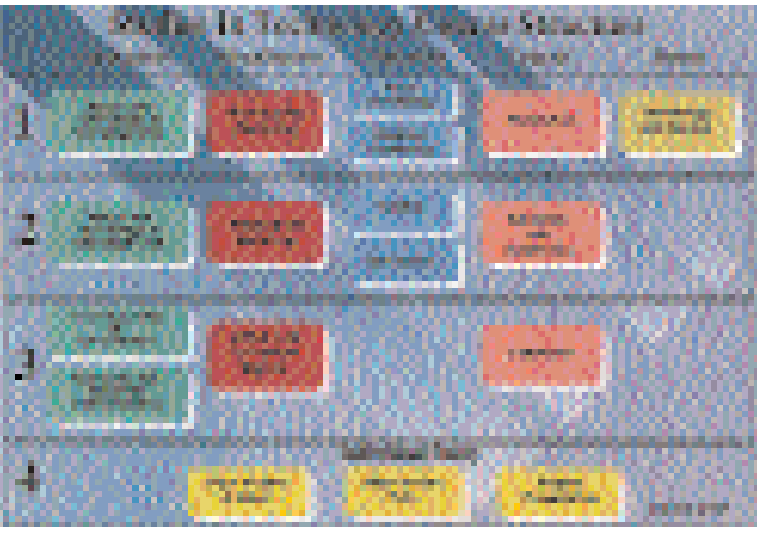
The students have specific inputs in Years 1, 2 and 4. In Year 1, all work is linked to the Key Stage 1 classroom (children aged 5-7 years) whilst in Year 2 all work is linked to the Key Stage 2 classroom (children aged 7-11 years). The two main foci are the development of appropriate knowledge and understanding and practical skills of the students and planning and assessment in relation to the writing of schemes of work and classroom implementation of design and technology. The delivery of the course has been innovative. Staff have developed strategies for teaching large groups of students, 80+, through the use of team teaching, video cameras, and feed back sessions. The students have whole year lecture inputs, practical workshops, small group work sessions and individual study time. In addition, they are encouraged to evaluate all design and technology work that they observe whilst working in schools. Assessment of the students takes place in Year 2. The assignment that they undertake involves them in making a high quality product, which they can use in their teaching. The students have to identify a need for the product such as a puppet/s to increase the children's interest at storytime, and to write a rationale for its use in the classroom. Whilst making their own product, the students are encouraged to work together to support each other in developing their own practical skills. Two workshops are available for them to work in during directed time and they are supported by staff, including a technician. In Year 4, time is allocated for design and technology as part of the students' Curriculum Update course. This takes place during the Spring Term to address the particular concerns which the students raise and to ensure that the students are fully aware of the latest curriculum developments, before taking up their first appointments.

Studies in Technology – the degree option

Studies in Technology is one of four subjects which students on the four year BA QTS Primary course can select to study. Students spend approximately one quarter of their time over the four years, following their subject study option. The component was started in September 1988 because it was thought that, being so broad in nature, and encompassing so many aspects of human knowledge, technology was an ideal vehicle for both teacher education, and the delivery of many aspects of the primary school curriculum. Indeed, Her Majesty's Inspectors (HMI) identified it as the first course of this nature in the country and it won the BP Partnership Award for the best primary course in the

country in 1993. The course is modular, constructed around a series of strands of technological experience.

The Course Structure



The aims of Studies In Technology can be stated basically as firstly to develop trainees' own technological capability in a wide range of media and secondly to give trainees an opportunity to develop a whole range of strategies for teaching technology in the primary classroom. Although each module focuses on one or other of these aims, they are both implicitly covered throughout the course as a whole.

In the first three years of the course, modules aim to extend the students' knowledge and skills in a wide range of media. Each component also provides them with opportunities to develop their own design and technology capability whilst undertaking activities involving this new knowledge and skill.

In the first year of the course, students learn about the technological advances of food preservation and storage, and are also involved in researching, developing and marketing a new food product. They learn about the concept of control using simple pneumatic devices, and work with resistant materials in order to build a model which can be operated by such a mechanism. Sessions on drawing and designing give students opportunities to experiment with this kind of communication, and after looking at the historical development of the newspaper industry, they develop their own desk-top publishing skills in the group production of a newspaper. An important feature of the first year is the study visit to the Centre For Alternative Technology in Wales, where aspects of alternative energy, and the role of technology within society are investigated.

In the second year, students look at textiles from both an historical and cultural perspective. They investigate structures and construction, and extend their work on control to include a systems approach to electronics. They are also able to enhance their visual communication skills further by looking at imaging and modelling as techniques within design.

In the third year students now have an ever-increasing repertoire of skills and knowledge on which to call, and so the activities are designed to be more open-ended in nature. An industrial placement gives students an opportunity to explore another unfamiliar context. The automata project enables the students to gain an in depth understanding of a range of mechanisms and extend their own designing and making skills.

Finally, in the fourth year, students work on their own individual study, having first identified a "client" to work for. This helps students understand the important differences and difficulties of designing for someone else's identified needs rather than their own.

Running parallel with these modules are components which look specifically at ways of teaching design and technology in the primary school, including the role of the co-ordinator.

Breadth, Depth and Progression

The course has been designed from its inception, to emphasise progression. At the start of the course, students are developing knowledge, skills and techniques utilising a wide range of media, and then using these in relatively structured activities, as well as engaging in the design and technological processes involved. Later in the course, the activities are more open ended, giving students the opportunity to select from their repertoire the appropriate knowledge and skills, and to identify their own constraints. In their individual study, they have a totally open-ended activity devised in consultation with a client, who will set many of the constraints.

The assignments are seen as an integrating feature of the course, as well as providing a clear mechanism for progression. This is done by ensuring that the criteria for assignments later in the course include aspects of work covered in earlier modules. This means, for example, that whilst involved in the introductory unit on control, the artefact they construct has to be designed making use of skills and techniques which they developed earlier in the designing and drawing component of the course.

Assignments are also designed to be useful pieces of work in their own right. For example, one assignment requires students to produce some good quality resource material for school use based on a week-long industrial placement. The material was then published "in-house" and trialled by students on teaching practice. All the students in the group therefore have a booklet containing their own material, covering aspects of Economic and Industrial Understanding – a useful source of ideas for future work.

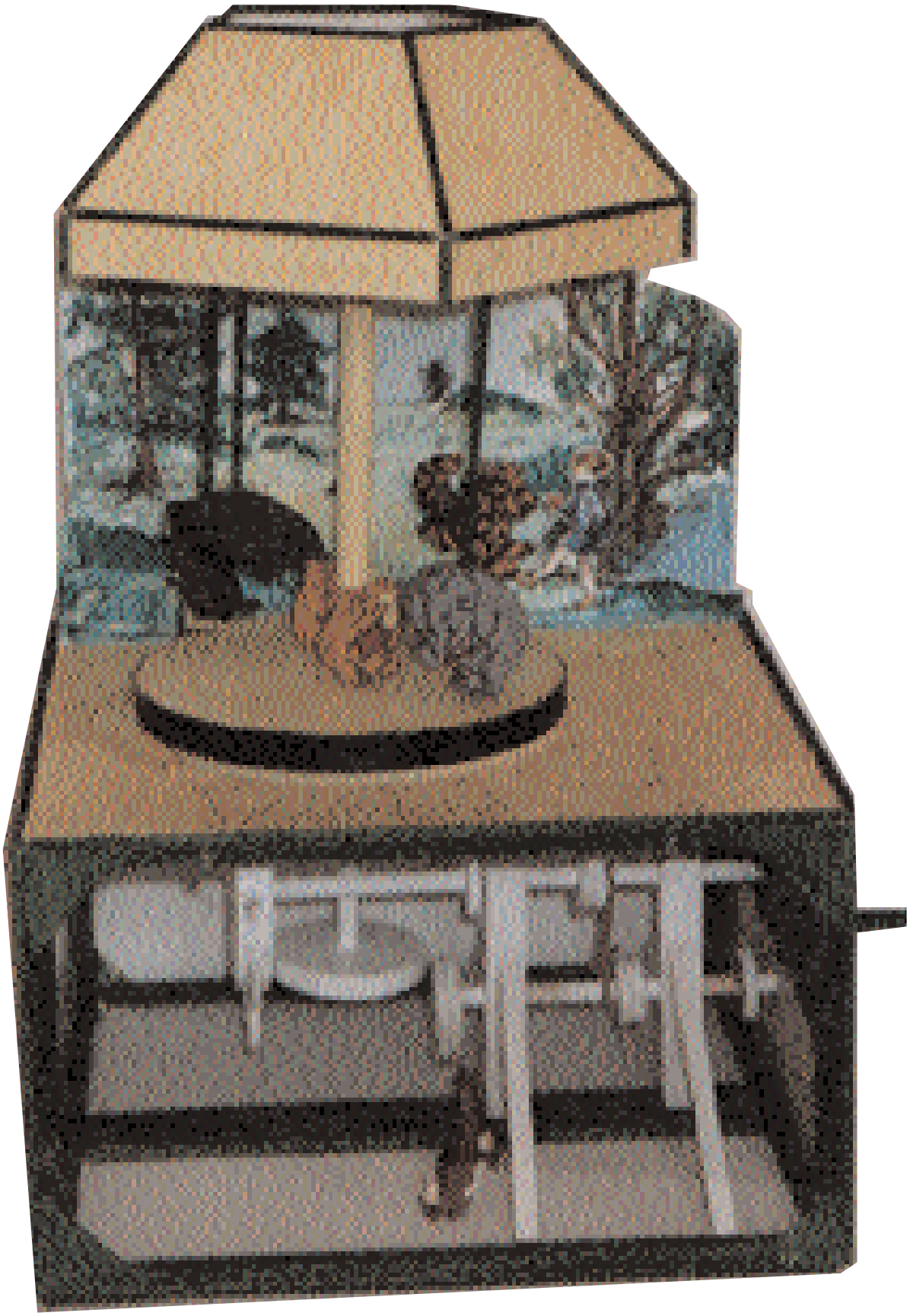
Students having successfully completed the Studies In Technology route are capable technologists with an awareness of most areas of technology, competent in many and expert in a few. They have also developed a wide range of strategies to teach children how to be involved in this innovative area of the curriculum, and with their background experiences and their enthusiasm, it is believed that they will do much to improve children's technology education.

From October 1997, this course will be modified as the students will then take two main subjects, not one. The programme will be shortened, but the underlying aims will remain the same.

Design and technology for PGCE primary students

The structure of this course has evolved over the last five years not only to provide a design and technology course but to provide students with more school-based work, to build partnership with schools, and to provide opportunities for In-service for teachers. This new approach was mainly the result of the identification of the need for curriculum development in design and technology by one cluster group of primary schools in Birmingham. Eleven schools took part in an initial project, with one teacher from each school working with a group of 5 or 6 students for the whole course.

The teachers who come on the course do not have expertise in the area of design and technology but bring with them the experience of managing a primary classroom. The first three sessions are designed to give both staff and students an understanding of the nature of design and technology, opportunities to develop practical capability and knowledge and understanding, strategies for the implementation of design and technology in the classroom and time to plan design and technology activities, which are carried out in the teachers' schools. Sessions 4, 5 and 6 are school based, and teachers, students and children carry out the planned activities. Session 7 is Faculty based, and teacher and students carry out an evaluation of the activities and discuss issues relating to the assessment of pupils and cross curricular links. It is now that strategies for developing pupils' design and evaluative skills are drawn out as both students and teachers have experience of children's work in these areas. Changes have been made since the course started, based on the final course evaluation. These have included a longer course, more time in school and a broader breadth of coverage of the National Curriculum requirements which is supported by course materials. A five year detailed evaluation of the



courses as part of a research project is almost completed and some consistent advantages and concerns are beginning to emerge. Both students and teachers find the classroom based work valuable (if only to show what should not be done) the support materials are a useful aid for future work and the practical sessions essential for the development of participants' skills.

Support for course development

As the input of design and technology into the primary ITE courses has increased, so has the need for a wide variety of resources. To support this work, the resource area is constantly updated. At this present time, the students have open access to a library containing the latest publications, computer programs and CD-ROMs, a range of appropriate materials and tools that they could use with the children and two network rooms where they can develop their computing skills. There are workshop facilities which are on open access for the students and a technician which ably supports them. Whilst there was a rapid response at UCE to introduce curriculum changes, course development is not static. Staff and student course evaluations provide one source of information on which future innovations are based.

Conclusion

It is obvious that for any area of the curriculum, courses in ITE immediately need to take account of changes that are taking place in school. For design and technology it was essential, yet much was left to chance.

In hindsight, the identification of key strategies for change would have aided the inclusion of design and technology into the curricular of ITE courses. Monitoring of course provision has been patchy. Whilst some institutions have had inspections by HMI in which design and technology has been a focus, majority have not. A clear development plan was needed but was not forthcoming.

The inclusion of design and technology as a legal requirement, the identification of a minimum time allocation for all students and the identification of a minimum entitlement for all students by the Department for Education may have gone some way to ensuring that all students had a course in design and technology from 1990. Seven years on from the introduction of design and technology, there are still some students going into school with little idea as to the nature of design and technology, nor how to teach it. However, with the introduction and implementation of the document 14/93, trainees have to gain a set of competences throughout their course, one of which relates to their abilities to successfully deliver the National Curriculum in primary classrooms. Without a suitable course, this competency will prove impossible to achieve. To support this need, in January 1996, following the successful initiative for secondary courses DATA held a conference to initiate the writing of a document relating to a suggested minimum entitlement for design and technology for all primary students. Initial teacher educators from all institutions were invited to take part; a working party was set up; and a document produced. There is therefore a suggested framework provided by DATA and at this time a number of institutions are already using this document with students to help them gain an overview of their needs and areas that they need to consolidate and develop.

References

- Alexander R, et al (1992)
  Curriculum organisation and classroom practice in primary schools: a discussion paper
  DES
- CATE (1989)
  Initial teacher training: Report
  DES
- CATE (1993)
  The initial training of primary school teachers
  Circular 14/93 (England)
  DES
- DATA (1995)
  Minimum competences for students to teach Design and Technology in Secondary Schools
  Wellesbourne, DATA
- DATA (1996)
  Guidance for primary phase Initial Teacher Training and Continuing Professional Development in design and technology
  Wellesbourne, DATA
- DFE
  National Curriculum for Design and Technology, 1994
  HMSO
- DFE
  National Curriculum for Design and Technology, 1995
  HMSO
- DFS
  National Curriculum for Design and Technology, 1990
  HMSO
- OFSTED (1993)
  Curriculum organisation and classroom practice in primary schools: a follow up report
  HMSO

KEYNOTE LECTURE

Training Teachers to Teach Design and Technology in Primary Schools

The Design and Technology Association (DATA)

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Andrew Breckon – Chief Executive of DATA

Introduction

The two areas of Information Technology and Design and Technology have had a confusing relationship due in part to their original inclusion in the same National Curriculum document. Of late, they have become more autonomous, but in many people's eyes, the word Technology is synonymous with both IT and D&T.

However, there are many areas in which IT has a very important role to play in the D&T experience, although as identified in Pritchard (1997), the development of children's IT capability through the medium of design and technology is not being exploited by many teachers. Using a desktop publishing program to produce a poster is a common task in D&T, but it would be equally applicable in many other areas of the curriculum. We need to focus in on the particular skills that will be enhanced by the children using IT, but we also need to look at activities that lend themselves particularly well to design and technology.

This case study will look at particular groups of content-free software, many of which are outlined in DATA et al (1996), and identify where they can make a definite contribution to the teaching and learning of design and technology in primary schools.

The context for design and technology

For many years practical activities took place in primary schools in this country. Some were craft-based activities, while others involved cooking and needlework. Much of this work was artistically oriented and little was scientifically or design-based. During the 1970s it became clear that there was a place for science and technology in the primary curriculum and many believed that the approach to science was through technology. Thus in the 1980s the government established the Education Support Grants initiative to introduce science and later technology into primary schools through teams of advisory teachers in every local education authority. When the Education Reform Act (1988) introduced the subjects of the National Curriculum science and technology were both present. The science National Curriculum working group was also given the brief for primary technology, with the view that primary science and technology were closely linked. When the design and technology working group was established, 12 months later, it had an initial remit for 11 to 16, however within 3 months it had taken over responsibility for primary design and technology from the science working group. The following is a list of the major reports leading to the development of the 1995 Order for Technology (Design and Technology):

Note: The reason I refer to the Order for Technology is that within the 1988 Education Reform Act, which is the primary legislation, only the word Technology is included as one of the 10 National Curriculum subjects. This has been interpreted as Design and Technology and Information Technology through subsequent Orders set before Parliament.

- 1989 – Working group proposals on design and technology to Secretary of State
- 1989 – National Curriculum Council (NCC) restructures and rewrites Order
- 1990 – Order for Technology published, consists of design and technology and IT
- 1992 – OFSTED reports inadequate implementation
- 1992 – Engineering Council publishes 'Technology in the National Curriculum'
- 1992 – NCC publishes case for revising the Order
- 1992 – OFSTED asked to draft new proposals for the Secretary of State, Technology for ages 5 to 16 (1992)
- 1993 – NCC publishes consultation and is asked to revise proposals
- 1993 – NCC publishes new proposals
- 1993 – Secretary of State asked Sir Ron Dearing to review the whole National Curriculum
- 1994 – New proposals for all 10 subjects in the National Curriculum
- 1995 – New Order for design and technology published, with a 5 year commitment not to change.

These publications chart the development of thinking about design and technology, and incidentally the thinking about how the National Curriculum should be structured. Although they display some significant changes of direction they are a useful source of guidance on progression in skills, processes and concepts.

The significance of these developments since 1988 cannot be underestimated, because design and technology is now a strong subject which has developed its own values and rationale and which is looking to make links with other subjects and provide a dynamic push in a highly competitive curriculum. There has been considerable industrial support for this work. Some have argued for closer links with science, and while in principle this is wise, it is important that scientific methodology does not swamp design and technology which has its own very valuable methodology and values. In the current English education system there is every chance that teaching methods and testing in primary science could have driven design and technology to an optional addendum if it had been part of science education.

Design and technology and its value to the primary curriculum and future citizens

One question which is frequently raised is the value of design and technology education to children. Design and technology is frequently defined as the purposeful use of knowledge, skills and physical resources to create products that meet a perceived need or opportunity. Thus design and technology fosters learning to design and make, but also learning through designing and making. It seeks to stimulate both intellectual and creative abilities and to develop personal qualities. The intellectual skills developed include investigation of the made world, research, analysis, synthesis, evaluation and critical reflection and appraisal. Personal qualities such as inventiveness, responsibility and commitment, teamwork, flexibility, resourcefulness, as well as a concern for the living environment are developed through focused tasks and designing and making assignments. Design and technology seeks to develop a culture which credits those who design and make products and show enterprise and ingenuity in their work. This need for cultural change can not be underestimated and is one of the powerful reasons for governmental support for the subject.

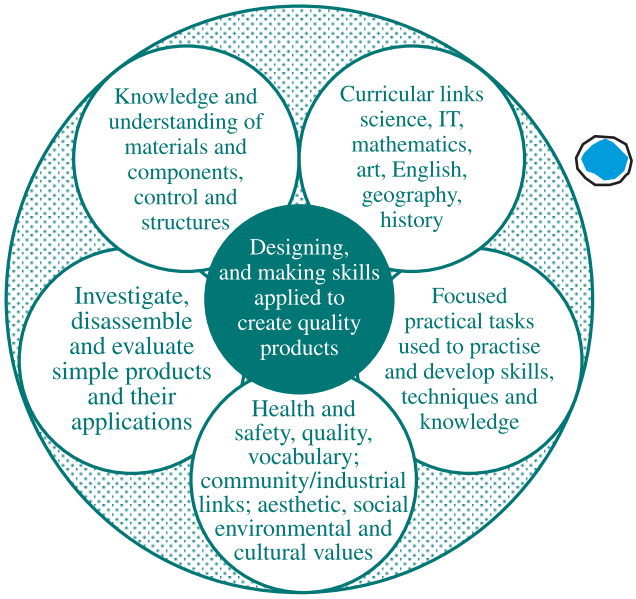
Design and technology provides an opportunity for children to operate in 'real-world' contexts in which they face technical, scientific, economic, aesthetic, moral and environmental challenges. This leads to the application of value judgements in situations where these can be assessed in a constructive manner. It is an area of the curriculum which provides a natural focus for many other subjects and a means of reinforcing those subjects or bringing them to life through meaningful practical activities. Coherent links or contexts for other areas of learning are essential, especially in science, mathematics, information technology and art. One of the key values of design and technology to the curriculum of a school is that it provides an opportunity for children to develop an understanding of technological processes, products, their manufacture and application, and the contribution of technology to our society. In so doing it should give children confidence about the technological world in which they live, as well as enabling them to feel able to contribute constructively in a technological society. This can be enhanced through the involvement of industrialists and business both within the school and also by taking children into industry.

The nature of design and technology

The nature of design and technology in the curriculum has been under debate for many years. There has been no large scale research and development programme to determine the nature of the subject in primary schools, although a consensus has emerged through cooperation between teachers, lecturers and advisers. This consensus was soundly reflected in the 1995 Order for design and technology, and can be defined as follows:

- Design and Technology is essentially about providing opportunities for children to develop their capability to create high-quality products through combining their designing and making skills with knowledge and understanding.

The nature of design and technology is such that it should provide opportunities for children to engage in activities that are challenging, relevant and motivating. Children should be encouraged to enjoy the subject, seek satisfaction and purpose, as well as experience a sense of wonder at their ability to design and make. It should give children the confidence to play a constructive role in a technological society. Any design and technological activity should be a learning experience whereby children's repertoire of knowledge, skills and understanding is extended and applied in increasingly more diverse and sophisticated ways.

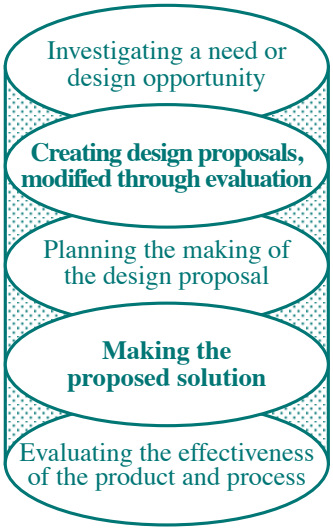


Designing and making

Children will use a range of communication skills, including verbal, graphical and modelling skills, to help their thinking and their ability to take action in the process of designing and making. They will also have opportunities to apply value judgements of an aesthetic, economic, moral, scientific and technical nature.

The knowledge and understanding used in design and technology are critical to the sound development of useful products. These will be taught specifically within design and technology, but will also be drawn from other curriculum areas such as science, mathematics, art, information technology and economic and industrial understanding. Design and technology will also contribute to these other curriculum areas and it is at its most valuable when the links with other subjects are natural, logical and coherent.

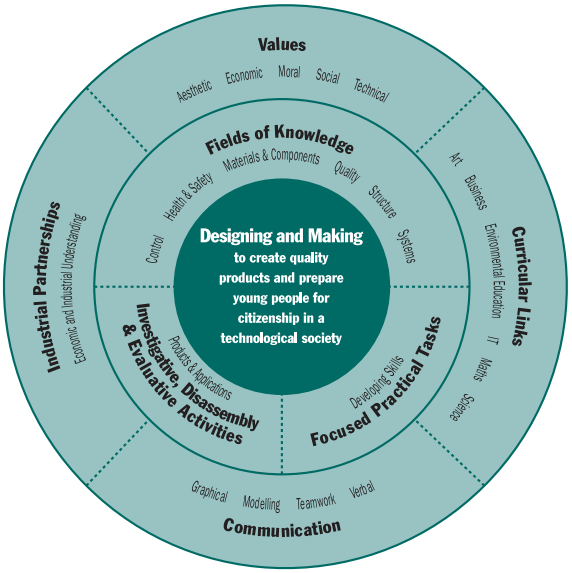
The teaching of design and technology is a distinctive creative process that combines intellectual with practical skills through purposeful practical activities. The creative process of designing and making in which children are engaged is iterative, but it involves a series of identifiable activities which overlap. The diagram below outlines these stages, with the two most critical stages in primary schools – the creation of design proposals and the making of the solution – shown in bold.



A process of planning

Design and technology in primary schools should introduce children to the concept of manufacturing and the applications of manufactured products. This should include some expression of the challenge of designing and manufacturing, as well as the evaluation of common products in terms of their success in technical, aesthetic and environmental terms.

The nature of design and technology is complex, with many interrelated elements, which make a major contribution to a child's learning when integrated in a designing and making activity. As work progresses the technological model becomes more complex. The model developed for secondary education illustrates this but with the same core activity.



Designing and making

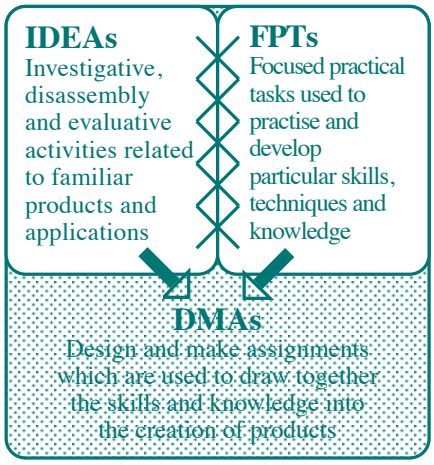
Design and technological activities in primary schools

DATA's research in 1995/6 and 1996/7 showed that design and technology is taught in primary schools in two basic ways. Seventy percent is taught through topics within the curriculum and 30 percent is taught as separate design and technological activities. At present there are three different ways of setting up design and technological activities:

- activities which are principally designed to provide design and technological experiences
- activities where design and technological experiences are an extension to an area of the curriculum
- activities where design and technological experiences are woven into or emerge from a topic or theme.

Each of these approaches has merits and some drawbacks, and some of the best results may be achieved with a combination of approaches over a key stage. Whatever the approach used, there are a number of specific activities which should be used in each key stage to develop design and technological capability. These are set out in the National Curriculum requirements for design and technology and are as follows:

- investigative, disassembly and evaluative activities (IDEAs) related to familiar products and applications
- focused practical tasks (FPTs), which can be used to practise and develop particular skills, techniques and knowledge
- design and make assignments (DMAs), which involve the making of quality products.



The relationship between the key activities in design and technology

The IDEAs and FPTs may either be used in isolation to develop particular skills or understanding, or may be the starting point for a designing and making assignment. Good practice is when the IDEAs and FPTs have the purpose of supporting and enriching the DMA. Sometimes starting an assignment with the investigation or disassembly of a product is a positive and constructive strategy for teaching. Equally it may be appropriate, when children are struggling with a particular skill during an assignment, to carry out a short FPT to improve their capability in order to help them create a better quality final product. FPTs can also be used to teach a specific skill, technique or process, as well as specific concepts. Teachers should be encouraged to use IDEAs, FPTs and DMAs in constructive integrated manner which will help children develop their capability.

Throughout the teaching of design and technology in primary schools it is crucial that language and literacy are developed. Design and technology provides rich opportunities for questioning, discussion, describing and explaining in both concrete and abstract forms. In addition children will be expected to become involved in seeking information and data and then determining what is valuable and what can be used in their work.

The programmes of study emphasise the development of a technical vocabulary. There are two elements of activities which need careful planning. The first is the use of correct and precise language at all times. However, the vocabulary which is appropriate to describe an item may change at different stages of a child's development. For example, a certain material may be called 'plastic' at Key Stage 1, 'acrylic' by the end of Key Stage 2 and 'poly(methyl methacrylate)' by Key Stage 4.

The development of drawing skills should also be planned into activities. It is worth noting at this stage the need to balance artistic freehand sketching and the development of the more formal technical drawing which is an important form of language in design and technology. In addition to the general language skills there are specific skills related to symbols and conventions of drawing.

The following summarise the design and technology requirements for primary aged children:

Key Stage 1 (4 to 7 year olds)

- Designing and making will involve:
  - use of a range of materials including: sheet materials, items that can be assembled to make products, textiles, food and construction kits
  - investigation of working characteristics of materials
  - application of skills, knowledge and understanding through designing and making.
- Design and technology has a knowledge base that is used to provide opportunities for the development of capability through IDEAs, FPTs and DMAs. The technological areas of knowledge and understanding are:
  - mechanisms
  - structures
  - products and applications
  - quality
  - health and safety
  - vocabulary.

Key Stage 2 (7 to 11 year olds)

- Designing and making will involve:
  - use of a range of materials including: stiff and flexible sheet materials, materials for frameworks, mouldable materials, textiles, food, electrical and mechanical components and construction kits
  - working in teams and individually
  - application of skills, knowledge and understanding through designing and making.
- Design and technology has a knowledge base that is used to provide opportunities for the development of capability through IDEAs, FPTs and DMAs. The technological areas of knowledge and understanding are:
  - materials and components
  - control
  - structures
  - products and applications
  - quality
  - health and safety
  - vocabulary.

Developing conceptual understanding of design and technological capability

It is vital that teachers have a grasp at a conceptual level of how children may progress in design and technology. Very little research has been carried out into how children learn to design and make products. Most of the early learning is

through first-hand tactile experiences and oral communication. Children's initial approach to recording their designing is retrospective and reflective, for example drawings of what they have made. However by the end of Key Stage 2 children are able to plan and evaluate their designing. This transformation in approach is conditioned by children's capacity to communicate in writing and through illustrations. Children's oral skills in communicating their ideas are usually far superior at the early stages of designing. Gradually, as the children move towards the end of Key Stage 2, they are able to communicate their designs in written and graphical forms more effectively.

Left to themselves, children studying design and technology would not develop as shown in the outline staged framework set out below. They will only develop along this pathway with guidance from the teacher.

The framework identifies a number of overlapping stages, and in order to help the teacher some rough indications related to years are given. Children may not progress in a linear manner and at the same rate on all aspects. Progression can be achieved with a careful structured approach to the teaching, although care must be taken not to inhibit creativity through the use of an inflexible structure. While significant aspects of design and technology will be conveyed through the quality of the communication – orally, and through drawing and using materials – it is important that teachers do not allow this aspect to play too dominant a part in the designing and making of a product. The following steps set out a simple picture which teachers may be able to hold in their mind to briefly illustrate some physical characteristics:

Stage 1 (Pre-school, reception and Year 1) Physical modelling of materials and components. Oral communication of what they are doing and have done. Retrospective drawing of what they have made. Recognition and identification of tools, materials and components.

Stage 2 (Years 1 and 2) Physical modelling of materials and components. Oral communication of what they plan to do, are doing and have done. Retrospective drawing of what they have made with some detail and labelling, also the naming of common tools and materials used in the designing and making. Children are able to describe in simple form the process of designing and making and why they have made certain decisions.

Stage 3 (Years 2 to 4) This is the phase when most children move from retrospective to prospective graphical communication. Children will start to show through sketches simple ideas and how these may work. Children will be able to express clearly the purpose of the product and will be able to label sketches and start to use colour to communicate their ideas more effectively. At this stage the concept of drawing simple plans and sequences through simple flow diagrams should be introduced. A significant amount of adjusting the design through modelling and making will continue at this stage. Pupils will be able to start combining and shaping materials to create products which meet their intentions.

Stage 4 (Years 4 to 6) By the end of Key Stage 2 children should be able to communicate, in graphical and written forms, their ideas and what they intend to make with most of the detail shown. The drawings should reflect the concept of scale and proportion, giving details of how parts work, and how they fit together with some dimensions. The children should be able to sketch plans and elevations, use symbols and make technical drawings, for example draw diagrams of circuits. At the higher levels children should be able to use drawing conventions, illustrate through simple exploded views and make written evaluative comments. The making is more complex, drawing upon a greater range of techniques to create quality products for different purposes.

To help draw out designing and related communication skills, and develop progression, schools will need draw to up clear guidance on how to structure responses from children. These will need to be linked to specific units of work. In some cases, simple prompts may be used to encourage responses. Whatever approach is adopted it is important to nurture creativity and spontaneity, while developing more analytical and evaluative skills. DATA has tried to create support in this area through its publications without imposition on teachers.

In this first part of the lecture I have tried to establish the why and what of design and technology in primary schools. The how is much more important to many in today's audience. I do not intend to show actual work of teachers and children as Mike Ive HMI will be doing that tomorrow, I want to look at structural issues in two key fields; staff training and resource needs.

Resource development

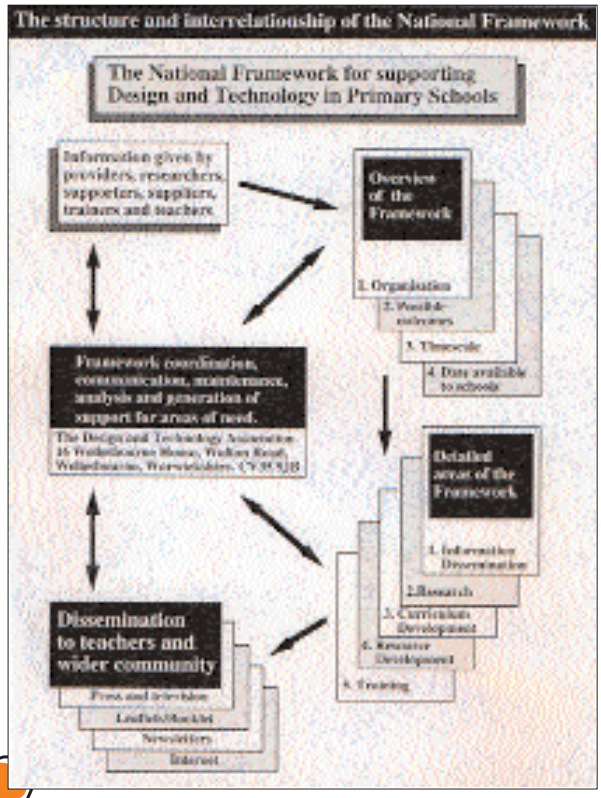
I will begin by briefly setting out some key points related to the development of resources. We in Britain have been very lucky with a range of excellent companies who support teachers through development of specialist tools, equipment and materials. These companies always work with teachers and many employ former teachers to ensure that their products are right for teachers. The DATA survey of 1996/7 shows that schools have £1.80 per pupil to spend on materials and equipment, against a DATA recommended figure of £3.60. Resources can be classified into five areas:

- Teaching environments – classrooms or specialist areas in classroom or specialist facilities
- Furniture – benches, trolleys, storage
- Equipment – tools, kits, computers, ovens, etc.

- Consumable materials – wood, card, plastic, textiles, food, components
- Learning supports – books, video, CD-ROM, software, activity cards, etc.

With more than 90 percent of design and technology being taught in the normal classroom this makes for major challenges for teachers.

With the support of the DfEE and a wide range of other bodies a National Framework for design and technology has been established and will be published in the Autumn term 1997. The framework is a matrix structure with five fields of information, which is illustrated below:



National Framework

Training teachers

Perhaps the biggest challenge to design and technology in primary schools in this country is to train our teachers. In more than 94 percent of our schools it is the class teacher who teaches the subject, yet few have received specific training in the subject. With 213,000 primary teachers working in our maintained schools in England and Wales, it means roughly there are 200,000 teachers who need training in the subject. Much has been done and I will return to this point latter in the paper, however it is worth noting that there are some 20,300 maintained primary schools, not to mention 1,600 independent schools.

The training of teachers in England and Wales is in two forms:

- Initial Teacher Training (ITT)
- Continual Professional Development (CPD)

The majority of teachers are graduates, most in primary education have a BEd, although increasingly there are teachers entering the profession with a main subject degree – usually in a National Curriculum subject, for example English, Mathematics, History, etc. – and then go on to a one year Postgraduate Certificate of Education. All teachers have to be qualified to teach in our schools, and all teachers are encouraged to participate in continuing professional development. In maintained state funded schools teachers' contracts include 5 days per year which can be used for professional development, when schools are open for staff but not children.

All ITT and CPD is now carried out under the guidance and control of the Teacher Training Agency (TTA) although it is likely many of these functions may in the next three years be transferred to the General Teaching Council (GTC) which the government is planning to establish. Recently the TTA has established a professional development framework for the profession. This has four levels:

- Headteacher
- Subject leader or Co-ordinator
- Expert teacher
- Qualified teacher (Entry level to the profession).

The full ramifications of this work are as yet unknown although the new government has already stated that the Headteacher qualifications will be a prerequisite for filling that post in the near future.

Initial Teacher Training (ITT)

Initial teacher training in primary education is usually geared to producing general teachers of all subjects although there are increased signs that more emphasis is being placed on training subject specialists.

Primary Teacher Training

In primary education the courses are either 3, 4 or a 1 year post graduate certificate of education. In general, teachers are trained to teach the whole of the National Curriculum. This means that training includes the following subjects:

- English
- Mathematics
- Science
- Design and Technology
- Information Technology
- Geography
- History

- Art
- Physical Education
- Music.

In addition teachers may well include religious education. The training courses will contain specialisms. The postgraduate courses are one year which means the successful candidate will have had to obtain a degree in one of the national curriculum subjects. It is therefore feasible to train as a primary teacher in England and not have had any specific training in design and technology, although almost all teachers (94% according to DATA survey 1996/7) will be expected to teach it. If you have specialised in design and technology at primary level, you will almost certainly become the school's co-ordinator within two years of completing your training. A co-ordinator is the person in a school who is responsible for taking the lead with a subject or area of the curriculum. The reason for this quick promotion is that many primary schools teachers have little background in technology and therefore feel ill-equipped and lack confidence to teach the subject, never mind provide leadership.

At present the government is reconsidering the training regulations in primary. It has brought out a National Curriculum for both English and mathematics and later will be developing one for science and possibly information technology, leaving other subjects to find their own subject-specific standards.

The Design and Technology Association (DATA) has produced its own 'national curriculum' for primary student teachers which is also a crucial audit and needs assessment instrument for continual professional development. This document, DATA Research Paper 7, is called 'Guidance for Primary Phase Initial Teacher Training and Continuing Professional Development in Design and Technology – Competences for Newly Qualified and Practising Teachers'.

This paper, which is accepted by the TTA, provides a much better definition of the knowledge and skills which teachers require in order to be able to teach design and technology.

DATA Research Paper 7 seeks to provide guidance on competences in design and technology for a range of differing audiences.

1 For those planning initial teacher training courses where design and technology is one element of a general primary course. These competences are set out as Tier 1 in the paper.
2 For those planning initial teacher training course with a specialism in design and technology. These competences are set out as Tier 2 and include Tier 1 in the paper.
3 For newly qualified teachers seeking to identify their strengths and areas for development at the start of their professional career, and help with their career entry profiles.
4 For existing teachers seeking to identify their own strengths and development needs in the subject.
5 For teachers seeking to prepare for subject leadership in design and technology.
6 For design and technology co-ordinators, professional development co-ordinators or senior staff seeking to audit staff skills and knowledge in design and technology.

To help these various audiences the competences are set out in two tiers:

Tier 1 Contains the minimum competences required of newly qualified teachers trained to teach design and technology, and for practising teachers to teach design and technology satisfactorily.

Tier 2 Builds on Tier 1 – and sets out the additional minimum competences for those newly qualified teachers trained as design and technology specialists, guidance on competences for practising teachers preparing for subject leadership and competences likely to characterise teachers who hold the post of subject leader in design and technology.

The competences are a crucial building block for any one setting out to firmly establish a subject in any country, if you want adequately trained teachers. The competences or standards as the TTA wish to call them are set out under the following headings:

- Curriculum Context, Planning and Assessment
  Whole curriculum
  Subject knowledge and application
  Assessment, recording and reporting
- Teaching Strategies
  Pupils learning
  Teaching strategies and techniques
- Designing and Making
  - Knowledge and Understanding
  Materials and components
  Control and systems
  Products and applications, and quality
  Health and Safety
- Further Professional Development.

The following examples gives an indication of elements of the competences for Primary teachers set out in the Research Paper 7.

Example 1

3.2 Subject Knowledge

Tier 1 Teachers should be able to:

3.2.1 demonstrate knowledge and understanding of the National Curriculum attainment targets and programmes of study in design and technology;

3.2.2 design effectively, employing design methods, using drawing (graphic) and other modelling techniques including IT to communicate their design proposals;

3.2.3 make products effectively, selecting appropriate tools and equipment to shape, form and combine materials and evaluate their products as they develop;

3.2.4 demonstrate technical knowledge and understanding of materials, ingredients and components, control systems, structures, products and applications.

Tier 2 In addition to Tier 1, teachers should be able to:

3.2.7 demonstrate a comprehensive knowledge and understanding of the National Curriculum attainment targets and programmes of study in design and technology;

3.2.8 design effectively using a variety of information sources; employing a range of design methods; exploring, developing and communicating design proposals through the use of formal drawing and modelling techniques in a variety of media, including the use of IT; and evaluate their ideas as they progress;

3.2.9 make products effectively, selecting appropriate materials, tools and equipment; skillfully using a range of processes to shape, form, combine and finish materials; evaluating their produces as they develop; testing on completion and implementing improvements to ensure products meet their original specifications;

3.2.10 demonstrate a depth of technical knowledge and understanding of materials, ingredients and components, control systems, structures, products and applications and the ability to use this knowledge and understanding in designing and making products of high quality.

Example 2

5.1 Designing

Tier 1 Teachers should be able to:

5.1.1 employ an appropriate method through which ideas can be generated, which take into account the uses and purpose of the design activity;

5.1.2 identify criteria for their design proposals;

Tier 2 Teachers should be able to:

5.1.1 identify and clarify design briefs and specifications; use sources of information and generate ideas considering a range of users and purposes for which they are designing;

5.1.2 understand and use a range of strategies and approaches to develop clear criteria for their designs including appearance, cost, function, reliability and safety, when developing design proposals;

5.2 Making

Tier 1 Teachers should be able to:

5.2.2 measure, mark out, cut and shape using at least one example of each type of material (stiff and flexible sheet, food, textiles, reclaimed materials, materials for frameworks, mouldable materials);

5.2.3 assemble, join and combine using these materials and appropriate components and ingredients to produce a quality product.

Tier 2 Teachers should be able to:

5.2.2 measure, mark out, cut, form and shape across that range of materials;

5.2.3 assemble, join and combine when using that range of materials incorporating the use of suitable components and ingredients as appropriate to produce a quality product.

Example 3

6.1 Materials and Components

Tier 1 Teachers should be able to:

General Requirements

6.1.1 make safe and appropriate use of range of tools relating to specific materials, components and ingredients;

6.1.2 use a working knowledge of techniques and tools for cutting, joining, forming and finishing materials;

6.1.3 consider the working characteristics of materials when making decisions to meet design requirements.

Tier 2 Teachers should be able to:

General Requirements

6.1.1 select and use competently and confidently a range of materials, ingredients, tools and equipment and act in accordance with appropriate health and safety measures;

6.1.2 apply an extensive range of techniques for cutting, joining, forming and finishing materials with precision and control;

6.1.3 demonstrate their knowledge of the working characteristics of materials when making decisions to meet design requirements.

Example 4

6.2 Control and Systems

Tier 1 Teachers should be able to:

Mechanical

6.2.1 use their working knowledge of a range of components when designing and making products eg. gears, cranks pulleys, levers;

6.2.3 describe how mechanical control makes things move in different directions and changes speeds and forces within the systems created;

6.2.4 use construction kits to demonstrate an understanding of the different forms of mechanical movement, including using linkages, levers, cams, pulleys, gears, and cranks to produce linear rotary oscillating and reciprocating motion;

6.2.6 make use of different sources of energy including electricity, gravity and wind when powering systems.

Tier 2 Teachers should be able to:

6.2.1 select confidently and competently components that meet specific design requirements;

6.2.3 use their knowledge of mechanical systems to make things move to meet design requirements;

6.2.4 use discrete components to demonstrate an understanding of the different forms of movement;

6.2.6 explain an energy transfer in the different products they have made and those made by others eg. electricity, gravity and wind.

Example 5

6.3 Products and Applications, and Quality

Tier 1 Teachers should be able to:

6.3.1 distinguish between aesthetic and functional influences in products;

6.3.2 employ a variety of techniques such as investigation, disassembly, evaluation and analysis to appraise existing and predicted products;

6.3.3 demonstrate a personal appreciation of the values implicit in technological solutions and consider the impact their own value systems have on children.

Tier 2 Teachers should be able to:

6.3.1 describe the aesthetic, functional and technical influences in products, and how these have influenced their designing and making;

6.3.2 evaluate the effectiveness of a range of product analysis techniques when examining products and applications;

6.3.3 analyse products and applications in relation to ethical factors such as impact on society, environmental effects and moral and cultural influences;

These give a flavour of what we are starting to require of our teachers in initial teacher education, although much still needs to be done before we reach a satisfactory standard in all institutions. However we now have the framework in which to work, and this framework is also applicable to CPD.

Continuing professional development

The second phase of training is what we call continuing professional development (CPD). CPD has been aided over the years by central government grants administered by local education authorities. This enabled support for teachers, not only by running courses, but also by very effective methods such as advisory teachers working alongside teachers in the classroom or workshop. This was probably the most effective method of creating change with teachers, and while it was expensive, it was good value for money. Today, the specialist grants have been reduced and only one central government grant is left in primary education for co-ordinators – in a number of areas even this is no longer available. This is a great loss.

In primary schools over the last six years we have had specialist funding for 20, 10 or 5 day courses which specialise in design and technology and from which approximately 14,000 teachers have benefited. Money is given to provide cover for the teacher and pay the course fees. These have been very useful courses, particularly the 20 day courses, which enabled a significant amount of work to be done with teachers to prepare them for co-ordinating the subject and taking it forward. There remain approximately 7,000 in need of training. DATA's research (1996/7) shows that co-ordinators change approximately every three years, and this is a major challenge. With this turnover it could be argued that 7,000 training places per year are needed, with a minimum of 8 days training. Advisory teachers also provide an excellent additional support and run many courses or support teachers in the classroom. This highly effective approach is however now not available in many local authorities and increasingly most training will be done in school or in teachers' own time. The government's aim was the use of what is called 'cascade' training, where teachers receive some training out of school and then return and train their colleagues. This method has proved rather ineffective, however, there are few alternatives without major increases in funding.

DATA is seeking to support the training in school with a major new publication called a School based INSET manual for Primary Design and Technology. This will be in two volumes, one available in November 1997 and the second volume in June 1998.

The future and conclusion

A number of critical elements are required to secure the future of the subject:

- continuing educational, industrial and political support
- consolidation of good practice
- raising of standards of achievement
- more and better training in both ITT and CPD
- development of new resources and approaches
- improved public understanding of the subject.

However the most important part of any programme must be to stimulate teachers to engage their pupils enthusiastically in the subject. Design and technology is educationally justified, culturally essential and can be great fun for pupils of all ages, a wonderful recipe for success.

While much still needs to be done, design and technology has come a long way in Britain and I hope colleagues from overseas can now see part of our infrastructure and thinking. I believe we have something which we should be very proud of and should celebrate. We will be celebrating in the year 2000 with an International Millennium Conference for Design and Technology.

I hope during this conference we can share our ideas, stimulate international support for this type of learning for the sake of our children, their children and our future society. I trust you have a valuable and enjoyable conference.

References

- DATA (1997)
  Planning into Practice – Design and Technology in Primary Schools
  Wellesbourne, DATA
- DATA (1997)
  Survey of Design and Technology in Schools 1996/7
  (DATA Research Paper No 8)
  Wellesbourne, DATA
- DATA (1996)
  The Design and Technology Primary Co-ordinators' File
  Wellesbourne, DATA
- DATA (1996)
  Guidance for Primary Phase Initial Teacher Training and
  Continuing Professional Development in Design and Technology
  (DATA Research Paper No 7)
  Wellesbourne, DATA
- DATA (1996)
  Primary Design and Technology –
  A Guide for Teacher Assistants
  Wellesbourne, DATA
- DATA (1996)
  Survey of Design and Technology in Schools 1995/6
  (DATA Research Paper No 5)
  Wellesbourne, DATA
- DATA (1995)
  Technical Vocabulary for Key Stages 1&2
  Wellesbourne, DATA
- DATA/DFEE (1995)
  Guidance Materials for Key Stages 1&2
  Wellesbourne, DATA
- DATA/DFEE (1995)
  Why Design and Technology
  Wellesbourne, DATA
- DFE (1995)
  The National Curriculum
  London, HMSO
- Eggleston J (1996)
  Teaching Design and Technology (2nd edition)
  Buckingham, Open University Press
- Kimbell R, Stables K and Green R (1996)
  Understanding Practice in Design and Technology
  Buckingham, Open University Press
- Richardson R (1996)
  Planning Primary Design and Technology
  London, John Murray
- SCAA (1995)
  Design and Technology: the new requirements
  London, HMSO

CASE STUDY 1

The Role of a Design and Technology Co-ordinator

Shaw Hill Primary School, Alum Rock Road, Birmingham, England. Telephone +44 121 327 2131

Beverley Peters – Design and Technology Co-ordinator

Introduction

This case study has been written with the intention of giving a personal reflection, of what I feel my role as a design and technology co-ordinator means within my school. It examines my very earliest experiences with relation to the National Curriculum orders, the influence it has had upon the school, the children and my role, and where I believe the future of design and technology lies within this particular school.

However, the discussion that follows is not suggesting we have a perfect working model because, as with many other areas of curriculum development, they are fraught with difficulties and setbacks.

Getting started

When I was first appointed the design and technology co-ordinator, there was little, if any, evidence that this subject was a part of whole-school curriculum planning. From an initial audit of resources in the school and teachers' skills, the central concern was that staff felt lacking in the skills that this subject required and revealed that their knowledge of designing and making and the National Curriculum documentation was inadequate. The very thought of tools and children together in the same room, shocked many of the staff and so they saw the simplest solution as being to ignore the making element of D&T. Others, addressed design and technology by producing 'designs' with the children, yet lacked the knowledge and understanding to take them further by developing and modifying them with the children.

Initially, my thoughts were to make an impact on the whole school and get everyone, regardless of the skills and knowledge that the children possessed to 'have a go' and produce 'evidence' which satisfied the programmes of study. This would identify particular 'taught' skills and ensure that design and technology was an established part of the curriculum map and medium term planning process.

In order that I could take this initiative forward and develop it, I needed time, staff commitment and confidence to work within the subject's framework. I did, and indeed still do, believe that the staffs' skills grow alongside their confidence and personal development. My aim became to support staff and encourage them to start from where they were at present. They also needed support in the form of school based In-service training, to encourage their approach to the planning, implementation and monitoring of design and technology and in developing their understanding of the programmes of study.

After discussions with the Head, design and technology was given medium priority in the school's development plan and resourced with extra financial support. I believed that planning for progression as part of a whole school curriculum would be the best way forward for our school and children.

The curriculum map divides the terms into topic-based approaches, linked to either science or the humanities and it was from these that I generated the ideas with specific topics in mind. Design and technology is cross curricular in its approach. Mathematical, scientific and artistic skills are featured extensively in many of the design and make activities. This made the task of introducing the design and technology curriculum a little easier. The next step was to produce exciting design and make assignments which would be stimulating and thought provoking and yet teach and build upon skills which would be progressive as the children moved through the school.

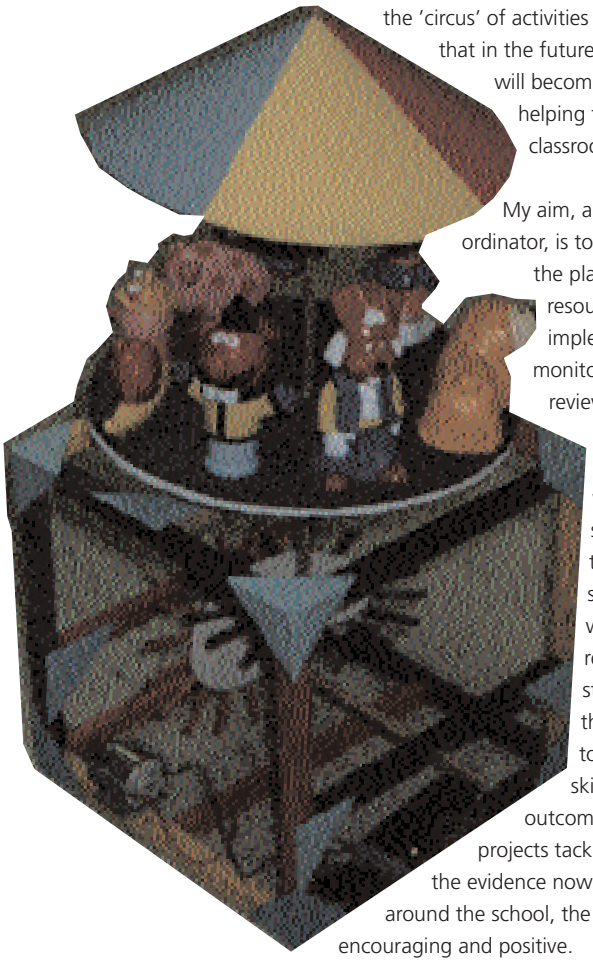
As they were closely related to the topic titles, many of the design assignments were also a part of scientific enquiry or promoted areas of maths, language and information technology. It was not financially viable to invite the City's advisory team in to lead an In-service programme but it was possible for me to attend a government funded 16 day course for D&T co-ordinators. This in turn, would give me the confidence and the level of expertise to develop our own initiatives. I also saw it as a way of negotiating time to work within my colleagues' classrooms, working alongside as support, and offering advice on classroom management and resourcing.

Staff were also asked to consider the programmes of study which state that children should use their knowledge and skills in other subjects to support their design and make projects. This 'whole curriculum' approach encouraged the staff to move towards incorporating design and technology within the topic cycle.

Ways forward

Design and technology is still a relatively new area of the curriculum and it is therefore still in the early stages of development. It is also important to remember that whilst staff may have identified a lack of knowledge and understanding of the subject, they still have an obligation to deliver the design and technology curriculum. The role of the co-ordinator, and indeed the headteacher, is to identify and meet the needs of the individual teachers.

In the two years I have been in post, I have worked on a curriculum plan, a policy has been developed and design and technology is now being taught with children involved in producing quality products each term. We, as a whole school, have hosted a successful curriculum evening for parents and children which highlighted the many areas of design and technology and the progression of skills from nursery to Year 6 (children aged 11 years). The parents were actively involved in



the 'circus' of activities and it is hoped that in the future our parents will become involved in helping teachers in the classroom.

My aim, and role as co-ordinator, is to support staff in the planning, resourcing, implementing, monitoring and reviewing the design and technology curriculum within my school. This year the present schemes of work will be reviewed and staff will have the opportunity to audit their skills and the outcomes of the projects tackled so far. From the evidence now displayed around the school, the results are encouraging and positive.

Working within the City, opportunities arise to meet with other design and technology co-ordinators from a wide representation of schools. From discussions within these groups it is quite evident that the role of the design and technology co-ordinator makes an important contribution to the whole school curriculum and to the development of the child.

It has become increasingly evident to me that the levels of achievement which each school will reach varies widely. I do not believe that I have addressed every issue relating to the design and technology curriculum and still feel that I have a long way to go before I can confidently say that we are delivering a successful design and technology curriculum. There is evidence of 'good practice' and enthusiasm from the staff. That, for me, at present is enough to be working on.

CASE STUDY 2

Creating a Primary School Design and Technology Workshop

The Hugo Meynell CE(C) Primary School, Loggerheads, Staffordshire, England. Telephone +44 1630 672287

Wesley Till – Deputy Headteacher

Introduction

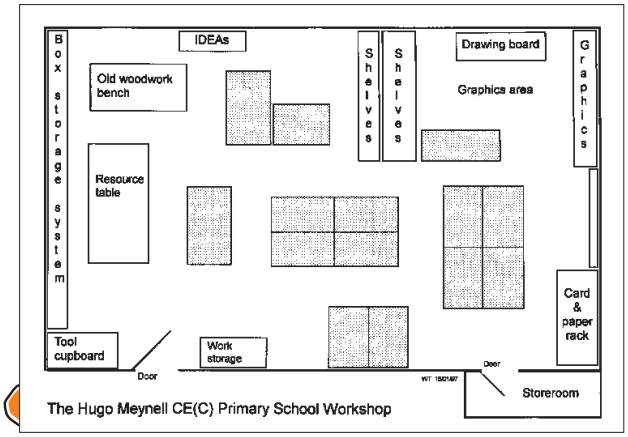
The end of the school year in July 1996 saw the departure of a much loved and respected member of staff. However, it is said that every cloud has a silver lining – and the early retirement of Mrs S. did in fact leave us with a surplus classroom. Since joining the school five terms previously I had been developing D&T with the familiar constraints of not enough room for resources (well actually no resources!), and the problem of trying to teach a practical subject in cramped teaching spaces.

This case study documents the process of adapting our surplus classroom into a dedicated teaching and resource area for design and technology. Practical advice is also offered to professional colleagues likely to be involved in the organisation of similar future projects.

August 1996

The planning stage – It appeared that there would be 4 main areas to consider and resource:

1 Consumable materials
2 Tools and equipment
3 Storage facilities
4 Tables and other furniture suitable for primary aged children.



A plan view showing the present workshop layout

September

One of the first things which I did was to make a computer generated sign announcing that the room would be called 'The Workshop'. Although this is a bit of outdated secondary school terminology I felt that it was easier for children to remember and pronounce than the alternative possibilities.

With the help of our school caretaker, I started to obtain likely furniture. Amongst the useful items acquired were some surplus tables previously used in the dining room. Being Formica topped these would be very serviceable as well as being useful for food technology activities.

Support from the school governing body has been received in many ways. Two of the governors regularly assist with design and technology lessons

In response to an earlier letter which I wrote to parents asking for classroom help, a parent started to come in on Thursday's to help repair and renovate the furniture. This involved sanding down and re-varnishing bookcases and tables. In a rather cold and damp part of school lay an old secondary school woodwork bench, which had seen much better days and required partly dismantling before it could be repaired. However, it is amazing what a coat of coloured polyurethane can hide and with a few pieces of new plywood on the top the bench was as good as new.

One of the storage systems which I had decided to adopt was that of using photocopier paper boxes with part of one end cut away. This is a cheap but effective way of storing small lightweight items such as film canisters, margarine containers and the like. A request to parents brought contacts with print rooms – the boxes came steadily in – and the cutting up of the 120 boxes needed became another job for a few kind hearted parents. We also adopted many of the other resource storage ideas suggested by DATA (1996).

October

I wrote a letter to all parents and governors explaining a bit about D&T and what we were starting to do with the room. To accompany what was basically a well worded begging letter I also obtained and sent out the DATA/DfEE leaflet about Design and Technology. I also attached a list of the types of resources which we would need, together with an 'artist's impression' of my vision of the workshop.

Our Autumn term parents evening also offered an opportunity to have a captive audience in which to advertise our plans for both the workshop and the subject. I also prepared and sent the local newspaper a press release – telling them of our plans but with the slant of a request for help if any reader could help with resources. A photographer subsequently came and captured a couple of rather sad looking children holding tools – but looking more like Oliver Twist when he famously asked for more!

Regional newspaper coverage of the workshop project proved useful in gaining support from local business and industry – by courtesy of The Shropshire Star

The publicity worked. Among the items received were a collection of industrial type storage units together with some racks for fixing them on. One of the advantages of working with primary school children is that they are always enthusiastic to help – seemingly with any task! Trying not to offend the ones left out, I established a small group of workshop monitors who would be responsible for putting away the growing collection of margarine containers, cardboard boxes and other recycled resources sent in by parents.

Another small group of children (from Year 6) also volunteered to stay on after school on a few occasions to lend a hand. Much of their time was spent following a well trodden route to the bins to deposit numerous unwanted items which had been gathering dust in the storeroom. Having now acquired a reasonable range of furniture I experimented with the layout of the room. One important fact that teaching D&T in a primary school has taught me is that it is essential that children are clearly made aware of what resources are (and are not) available for use with their activities. If this is not done, and other resources are openly available, then children can approach their work with the enthusiasm of the winner of a supermarket dash – grabbing and using everything in sight! To hopefully avoid this situation I allocated and named a separate 'Resource Table' onto which resources to be used would be put prior to starting each lesson.

An eagle eyed colleague noticed an advert in the county bulletin for two woodwork benches offered for sale by a primary school in another part of the county. At £15 each complete with vices these had got to be the bargain of the month! The furniture renovation and painting continued.

November

Using the computer again I made some signs to indicate the different parts of the workshop. These included Graphics Area, Storeroom, Resource Table, Tool Shelves to name but a few. I also felt that it was important for other classes, staff and visitors to see examples of work in progress and so an old bookcase was allocated to be a 'Work in Progress' display case. Another specific named area making use of an old bookcase and tray unit was to be an IDEAs area – not for children to sit and wait for the inspirational type of ideas – but a dedicated place to store items for investigative, disassembly and evaluative activities (IDEA's). Among the items collected so far are several telephones, door locks, a hair dryer, an electric drill, clocks and an assortment of electrical items including switches, plugs, and sockets. The intention is to gather a wide selection of items which are featured on the CD-ROM 'The Way Things Work' produced by Dorling Kindersley. The children can then use IT to find out as much as possible about the items which they are investigating.

Another material aspect which I focused on at this time was that of textiles and we started to build up a stock of fabric offcuts which were stored in the photocopier paper boxes. I also put out an appeal for wool, cotton and thread.

Having had a modest amount of capitation allocated to spend on D&T materials, I had deliberately delayed writing orders in order to avoid purchasing items which I might otherwise have 'acquired'. However, the time had come to order non-scroungable resources, and so after collecting the inevitable carrier bag full of catalogues at the annual D&T exhibition at the NEC, I hastily prepared orders mainly for items such as dowel, wood and consumable electrical components.

An example of co-operation learning. Using the workshop facilities, children from Year 4 helped the Year 1 class to design and make pop-up flowers for Easter

December

Primary colleagues will know that Christmas concert rehearsals, class parties and other end of term events dominate the final month of the year. However there was still much to be done before the workshop could be considered ready for use. The notice boards were still bare, and so I put together some displays of graphics work including examples of our recently revised design sheets and booklets which we use to record D&T activities. I also displayed suitably labelled photos of previous D&T projects.

One of the last areas to be established was the graphics area. To make it look as intended I arranged a couple of small tables together with a selection of equipment such as pencils, felt tips, compasses and rulers etc. Using the tops of photocopier paper boxes as storage trays I also laid out a supply of design sheets and booklets. Our school's collection of D&T publications and other teacher resources were rounded up and displayed in a suitable location adjacent to the graphics area.

January 1997 – The Grand Opening!

The workshop started to host weekly timetabled D&T and science lessons, as well as proving itself useful by providing a practical working space for other occasional activities. Acquisitions have continued this year. Courtesy of a local tyre manufacturer we have obtained a large drawing board which fits in well in the graphics area. Items for investigation and disassembly seem to appear weekly, and a local joiner has started to supply us with useful offcuts.

Our first major use of the workshop for food activities came on Shrove Tuesday when all of the children in years 3 and 4 prepared and made pancakes. Although it was more like a production line with children making the pancakes as focused practical tasks, the experience did provide us with ideas for how to best make use of the space for food activities.

The workshop has now been in full use for several months, and whilst much work still needs to be done it has become obvious

that our school now has a really useful resource. From our experiences so far I have briefly listed the advantages and disadvantages of having such a dedicated teaching space:

Advantages

- The workshop has enabled us to have an area to keep D&T resources together. My classroom is now a lot tidier now that the D&T resources are elsewhere!
- The room has proved to be an extremely useful teaching space – not just for design and technology but also for science, art and practical aspects of maths.
- The profile of Design and Technology has been raised throughout the school community. Children see using the workshop as being something special.

Problems/Disadvantages

- There can be timetable problems, and there is always a danger that the room may get that popular that several colleagues may want to use it at the same time.
- With any shared teaching space there is always a danger that the room can become untidy as colleagues rush in and out often leaving resources depleted and workspaces messy. At the moment I am endeavouring to keep the room tidy using a combination of diplomacy, notices and monitors.

From my experience of setting up the workshop these are some tips for colleagues considering developing a dedicated teaching space for D&T and other practical subjects:

- Allow plenty of time. If anything double, triple or even quadruple the amount of time which you first estimate that setting up the area will take!
- Tell as many people connected with the school as possible about what you are doing. If approached in the right way parents can frequently offer the extra pairs of hands vital for the success of the project. Parents and governors also have tremendous contacts with business and industry and can invariably help with the acquisition of many resources.
- Refer to the advice offered by DATA (1996) in their Primary Co-ordinators' file. This contains a wealth of ideas relating to many aspects of D&T as well as suggesting ideas for managing the learning environment.
- Choose a small group of children to act as workshop monitors. They can be responsible for tasks such as keeping resource containers tidy and getting tools and equipment out prior to lessons. Another duty which our monitors have proved excellent in doing has been to act as official guides to parents and other school visitors when coming to see the workshop.

Its been a lot of hard work, and its taken a lot of time. But it has been worth it!

References

- DATA (1996)
  The Primary Design and Technology Co-ordinators' File
  The Design and Technology Association
  Wellesbourne, England.

CASE STUDY 3

Successes and Failures – A Case Study Showing the Development of Design and Technology Following an In-service Training Course.

Wyndcliffe Infants and Nursery School, Little Green Lane, Birmingham, England, B9 5AG. Telephone +44 121 772 0671

Lorna McNab – Design and Technology Co-ordinator

Background

In 1996, design and technology at Wyndcliffe Infants and Nursery needed development! There was no assigned co-ordinator for this subject. What members of staff thought was design and technology was actually 3D art. There was an overall fear and lack of understanding of the subject area. Relevant literature often was left on the shelf to collect dust.

In June 1996 I was informed that, as from September, I would become the design and technology co-ordinator. After some initial doubts, I decided that this was an opportunity to develop a curriculum area from the beginning. I have always enjoyed doing practical things and initially I saw design and technology as an opportunity of doing this. However, I was not familiar with the new orders or technical terms used in the subject. Due to my lack of knowledge, the headteacher and I decided that it would be useful for me to attend the DATA conference, at Warwick University, to update my knowledge.

The course was very beneficial but it left me feeling out of my depth, because there were so many things that we were not doing within our school. As a result I became slightly overwhelmed. However, it was suggested that I get in touch with the Birmingham Curriculum Support Service, to enquire about In-service training courses in design and technology. On making contact, I informed them of the situation relating to design and technology in my school and explained that I would like to attend some In-service training. At that particular time it was uncertain as to whether the course would be available, but a local education authority support teacher offered to come and spend a day in school with me to help me understand the new orders and to get design and technology up and running.

Once I was familiar with the terms investigate, disassemble and evaluate activities (IDEAs), focused practical tasks (FPTs) and design and make assignments (DMAs), I was then assisted to write schemes of work using the Birmingham planning sheet. I found that planning day to be extremely valuable. It was from then that my perspectives changed and my enthusiasm rose again. I was determined to make design and technology work in Wyndcliffe Infants.

A few weeks later I was informed that the In-service training course would be going ahead and that I had been given a place. I had high expectations of the course and hoped that it would help me develop more knowledge about the subject and how to put that knowledge into practice. My main concern was with my making skills. I had no idea how to saw wood or use other tools correctly. I had no prior experience in making skills for design and technology and I was not familiar with the different names of the materials and tools used.

When I arrived at the course, I was given a programme of what topics would be covered over the 20 days. My confidence was boosted when I realised that the course intended to cover so many aspects of design and technology relevant to a co-ordinator. We started off by discussing the nature of design and technology, focusing on what design and technology actually is and relating it to the programmes of study. Guidelines were given on how to plan for progression in schemes of work and ideas given for starting points. We then focused on what is designing and how designing skills can be developed with children. Here we looked at how children are able to communicate their ideas through the form of drawings, discussions, modelling and other media.

A session was given on the use of construction kits. I found this valuable because I felt and believed that the staff and myself were not using construction kits to their full potential. The first part of the session was presented by a representative from Lego, where

we were able to explore the different kits available for each key stage and to see how many were used for problem solving. Following this we were given the opportunity to evaluate a variety of construction kits, identifying their strengths and weaknesses. Examples of how to carryout audits for construction kits were also given.

The role of the co-ordinator was addressed, focusing on tasks such as writing a school policy and carrying out In-service training. Once the theoretical work had been covered, the course then focused on the different types of materials used in design and technology. For each material explored, background information was given and then we had the opportunity to engage in practical activities using these materials. The first focus was reclaimed materials where we considered issues such as storage, how materials may be strengthened, how materials can be joined together, and how to organise the classroom for this type of activity.

Following this, we then focused on paper and card and how they can be used effectively. Coverage was given on structures in which many unfamiliar terms were defined and explained. An extensive coverage was given on mechanisms. The course looked at levers, slides, hinges, springs, pneumatics, hydraulics, pulleys, gears, and cams. Each was looked at in some detail and opportunities were given to engage in practical activities, to gain a deeper understanding of these mechanisms. The course continued to look at other aspects such as electricity, food, textiles, health and safety and we discussed areas such as progression, designing and making skills, classroom organisation and assessment and record keeping.

All the skills that were acquired and developed during the course then had to be applied to a major making project, at the Martineau centre. The major making project took place over six days of the course mainly using resistant materials. The assignment required us to use at least two different mechanism and some form of electricity.

I have gained a great deal from this course and learned a lot from my successes and failures. The first thing that I learned, was to plan out exactly what I was going to do when making my product. This became evident when I was making a train from reclaimed materials. I was working with my colleague, Louise Wells from Canterbury Cross Primary school. We decided to work together and to make the same train. Having planned what we were going to do, or so we thought, we started to make our train. We decided to strengthen the structure of our boxes by filling it with newspaper. Once we filled the box, we sealed it and then attempted to push a dowel rod through the box to make an axle. As you can imagine, the rod would not go through the box because we filled it with newspaper. When we realised what we had done, we could not believe that we made such a mistake. However, this was not our last, but we always worked to overcome problems and learnt so much through doing this. Looking at books and having lectures would have been no adequate substitute. Through my failures, I realised the importance of planning thoroughly, before attempting to make the product. Throughout the weeks on the course my making skills developed. I continued to make mistakes but with guidance from the course providers, I managed to turn my failures into successes every time.

When carrying out my major making project, I was able to put my knowledge of cams and gears into action. This project was the turning point for me. It was a way of assessing whether I could put all of what I have learnt into practice. I did experience some difficulties due to technical problems but, for the first time, I actually felt like I knew what I was doing. I did need help now and then, but I was much more confident about my making skills.

For my project I made a circus trailer with gears to turn a turntable, cams to make a monkey bob up and down out of a box and two cams on either side of a clown to move its arm in order to play a drum. The trailer was controlled by a motor using a worm gear. There was a reversible switch, which I had to attach all the wires in the right places. At the front the trailer was a face of a clown made up of light emitting diodes. These lights were attached to a device linked to the computer. The package was called 'I-Control' and was used to flash the lights on and off on the front of the trailer. I am really proud of my achievements and feel that I have come a long way from those first few days when using reclaimed materials.

During and after the course, I shared with the staff at school the different experiences I have had. My aim was to promote as much enthusiasm as possible for this subject. Based on the knowledge I had, I was able to write a policy for design and technology and start writing schemes of work for the school. These are now still in progress. I have led an In-service training course on the IDEA section in the curriculum, which the staff said they enjoyed and which proved to be beneficial to them.

The way forward, I believe, is to provide In-service training on focused practical tasks. This would enable me to teach the staff the skills which I learnt and which are relevant to the schemes of work. I would like to focus on assessment and record keeping and be able to monitor and give support in classrooms, to staff who are not confident with this subject. My whole aim for the school for the future, is to ensure that we have an effective design and technology programme which allows for progression and continuity, which is realistic and which will develop the necessary knowledge and understanding and skills in children. Although we have a long way to go, we have come a long way from nothing!

CASE STUDY 4

The Development of Design and Technology in a School Following an In-service Course

Canterbury Cross Primary School, Canterbury Road, Perry Barr, Birmingham, England. Telephone +44 121 356 5321

Louise Wells – Design and Technology Co-ordinator

Background

Since I qualified as a primary teacher I have been working in a Birmingham school teaching the whole of the National Curriculum. In February 1996, I took on the responsibility of Design and Technology throughout the whole school from nursery to year six. Although I knew very little about the subject I was willing to learn. At the beginning of the financial year in April 1996 I was fortunate enough to be able to choose In-service courses for the next twelve months. I chose a two day course called Postholders and Design & Technology. This course was very useful but made me feel very insecure about Design and Technology and, in particular, my own lack of knowledge. It was on this course however that our local education authority support teacher mentioned that there was government funding for a twenty day design and technology course for postholders, and recommended it to us. He said that the course would be of great value to us and would cover all of the fundamental issues required for planning, implementing and teaching D&T in the primary school. At this point I was not very familiar with the D&T curriculum, nor did I have the knowledge, understanding and skills required to teach or lead the development of the subject effectively.

Training

In my school there was a scheme that had just been completed and was ready to implement, there was a range of equipment which needed to be reorganised but there was no policy. I felt extremely out of my depth. Even the thought of managing a budget was a frightening one. I had no idea what to order with the remaining budget or what to do with the resources and equipment once they had been purchased.

I was therefore delighted to receive confirmation that I had been accepted on the course. I turned up on the first day feeling a little apprehensive as to whether anybody else would be at the same stage as myself. I also hoped that the course would be the answer to all my problems, and queries, in that it would provide information on resources and equipment eg.:

- What was available, where to purchase the resources and what to do with them once they had arrived.
- Practical ideas and advice
- Explanations of the terms within the National Curriculum
- Planning catering for early years, Key Stage One and Key Stage Two
- The opportunity to have practical experience of designing and making.

Having completed the twenty day course I now feel completely different about the subject and how to tackle it. The content of the course was varied and covered many different aspects from interpreting the curriculum document and its terms, to putting this information into practice. Much of the time on the course was spent designing and making, allowing us to experiment with a wide variety of materials, equipment and resources, in order to make products which we felt would be applicable to our own individual schools. Then we were allowed to experience making with the added asset of having experts on hand, to help us get over problems when things went wrong, suggest further ideas and alternatives, and guide us regarding the use of materials and the safe use of tools. By having the opportunity to make products for ourselves we experienced what it would be like to be a child in the class being frustrated when things went wrong and not knowing what to do next:

- needing assistance when using equipment
- locating resources
- learning that mistakes can be rectified and that this enhanced the making process.

One of the most important lessons learnt was that design and technology is inspiring and fun, even when things go wrong. It allows children to experiment with their ideas and attempt to solve problems. Throughout the course we had plenty of opportunity to work with other colleagues, and discuss our problems and different situations in school. It was satisfying to know that there were other D&T co-ordinators who were in the same position as myself and shared the same anxieties.

By the end of the course I had a greater knowledge, understanding and practical ability than I had at the start.

- The National Curriculum was more accessible to read and understand
- I knew the names of most tools and how to use them safely and correctly
- I knew what mechanisms and structures were, how to make them and in what context to use them.
- Above all, I left the course with a very positive attitude towards the subject and its possibilities within school, and the confidence to begin to make changes and to assist the staff in implementing the changes. I knew that my skills would now allow me to carry out my post holders position more effectively and efficiently.

Implementation

Once the course had finished and I was back in school, I began to use my new knowledge and understanding to produce a school policy, and begin to rewrite and amend the scheme of work. First of all the staff filled in an evaluation form commenting on the current scheme, suggesting which tasks they felt worked and which ones did not. Then I met with each year group to discuss

the changes. As a final part of the course our local education teacher consultant, came and spent half a day at school discussing my proposals.

As a result of this meeting I am in the process of writing the scheme of work from nursery to year six, leading 'after school' workshops with individual year groups introducing new skills, equipment and ideas for implementing parts of their scheme (mainly concerning resistant materials).

This has been successful so far, as the staff involved are feeling more confident and understand more clearly what is required. It has also made me realise that within the school I am the 'expert', as I have now got a broader understanding and knowledge in order to help and advise colleagues. The feedback from those staff involved with the workshops is that they are now feeling enthusiastic about teaching D&T this term. I am looking forward to seeing the children and staff working together in the subject to produce quality pieces of work, and to see satisfaction on the faces of both parties. I have also ordered more equipment, resources, and published material which I am in the process of auditing and reorganising to make them more accessible to both staff and pupils. I have also reorganised our existing construction kits so that they are easier to use. I am also aware that we need some different construction kits that would be more appropriate to the new scheme of work. Without having the opportunity to participate in the twenty day In-service course I would not have felt confident enough to make the changes that are now in progress.

My intention now is to complete the full scheme of work, implement and resource it, as well as providing staff with support through meetings, and workshops throughout the school. The scheme will hopefully be ready to fully implement by September 1997. Throughout the next academic year I intend to monitor the scheme, and provide guidance where required. I also hope to introduce a proforma for colleagues to use to aid their planning.

The twenty day In-service course has been a great asset and I feel that it has enhanced my personal and subject development greatly. I feel that it has provided me with a good foundation for the future especially as I have been given this chance so early on in my teaching career. I will value this experience for a long time to come and take it with me through my career.

CASE STUDY 5

Starting from Scratch – Planning for Design and Technology

Danesmore Park Primary School, Wednesfield, Wolverhampton, West Midlands. Telephone +44 1902 305938

Sue Vaughan – Design and Technology Co-ordinator. Norman Snell – Acting Deputy Headteacher

Background

Danesmore Park Primary School is situated in Wednesfield, a district in the north of Wolverhampton. There are approximately 250 children on roll, with a further 40 children who attend the nursery part time. The school has a Designated Base for pupils with moderate learning difficulties (MLD). At present 18 pupils have Statements of Special Educational Needs for MLD. There are also approximately 50 pupils who are on the Special Needs Audit and require extra support. The school policy is that the Special Needs children are fully integrated into mainstream classes with additional support to meet their needs. Classes in Key Stage 2 are vertically grouped – Years 3 and 4 together and 5 and 6 together.

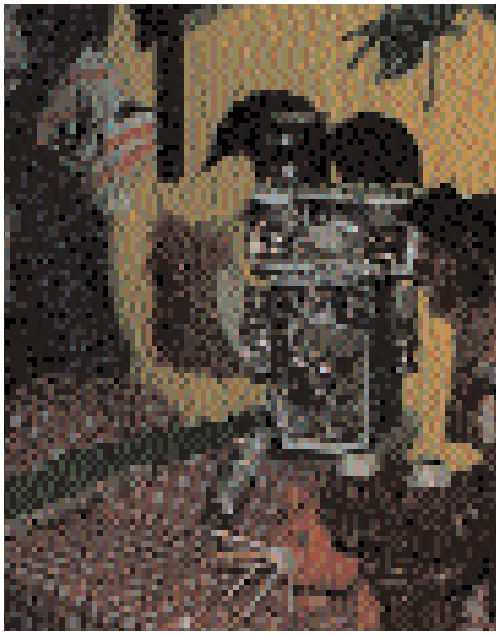
Design and Technology within the school was our weakest curriculum area. This was due to lack of confidence, expertise and understanding amongst the staff. Some junk modelling was going on in school along with basic skills, but the children were not getting the experience of skills, techniques and materials necessary to meet National Curriculum requirements.

Upon the appointment of a Design and Technology Co-ordinator (which also included Art and Information Technology), a new focus was placed on the subject. The Design and Technology Co-ordinator was unqualified in Design and Technology, but had art training and was aware of skills which would overlap these two areas. Due to this subject being highlighted on the school development plan, the primary objectives were to investigate published materials which would support the teaching of D&T in the school and to ensure continuity and progression throughout the key stages.

Professional development was given to the co-ordinator. Courses attended were 'Planning for Design and Technology' and 'Developing a policy for Design and Technology'. It was on these courses that the DATA Guidance Materials for Key Stages 1 and 2 were introduced to the co-ordinator and she saw the possible benefits of using the units of work within school. To the inexperienced co-ordinator and staff, the material provided clear structured guidance covering all aspects of the National Curriculum.

Development

Upon discussion with staff it was decided to adopt DATA's Guidance materials as a basis for developing a structured scheme throughout the school. It was agreed to trial the units of work for two years and evaluate the outcome. Units were selected where possible to link with existing topic programmes (science, geography and history based). If there was no natural link, then units were selected to ensure coverage of all necessary skills, knowledge and materials, as required by the National Curriculum.



Units were chosen so that each year group in Key Stage 1 covered three units of work thus meeting the requirements of the programmes of study in that key stage. In Key Stage 2, pupils are vertically grouped, thus the units of work have to be rotated on a two year cycle. The pupils will have experience of working with each material at least twice in Key Stage 2, ensuring continuity and progression

Staff welcomed the introduction of the units of work because they felt they gave a clear framework. The way the units are set out with clearly defined headings, gave staff much more confidence to teach the various D&T activities required, eg. investigative disassembly and evaluative activities (IDEAs), Focused practical tasks (FPTs) and design and make assignments (DMAs). The units of work gave staff a valuable starting point. Most staff have followed the units quite closely, again due to lack of confidence and expertise, but upon discussion and completion of units, they are able to see how modifications and developments could be made next time. Note has been taken of these for future planning.

Implications

The introduction of a scheme of work for D&T has had great implications for resources in school. This subject has had to have a priority in the school development plan which has budget implications. We have had to 'start from scratch' in all areas of D&T, including the resourcing of it. We have had to buy all tools, and materials necessary to carry out the projects. From experience, we have found that it is essential that the appropriate tools and materials are available for the children to use and that there are enough of them. We felt as a staff, that if we were going to improve standards in this subject, then the necessary materials had to be bought. If children are to produce a 'quality product' then quality materials are needed to ensure success.

At the moment, because the children have had little D&T experience, we find that their initial starting point is quite low – we have to assume that they too are 'starting from scratch' and have to learn all necessary skills. As the scheme develops

A display of the high quality products produced by reception age

throughout the school, we are aiming to ensure more continuity and progression – each year having a higher starting point and therefore raising standards. We are well aware that this will not happen overnight, and will require sustained effort and resourcing over a period of years. As the children's and staff's confidence builds in this area, so will expectations. We have now been trialling the units of work for twelve months – but even after such a short time, it is evident that great improvements are being made – by both staff and children. Some excellent pieces of work have already been produced, boosting the morale of staff and the enjoyment of the children.

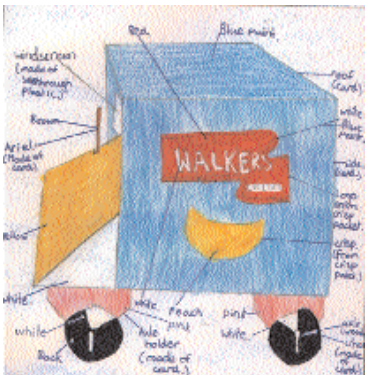
An advantage of starting from a low base has been 'equality for all'. The children have all started from the same point and the projects covered have enabled all children to work at their own level. Some of our MLD children have worked particularly well on D&T activities where they can work in parallel with (and sometimes to a higher standard than) their peers. We have also found it a useful way to break down stereotyping. Many of our girls have produced excellent work in woodwork while many of the boys have produced high quality work in textiles. We have experienced no negative attitudes from boys or girls in respect of D&T units covered so far – all children have been enthusiastic about new work and especially using new tools. The children have had a careful framework to work to, which at the same time allows them to develop their individuality through their designs. This has helped to keep them motivated and interested.

We have tried to encourage the children to evaluate their own work at each stage, and to produce a final evaluation sheet to a standard format, which highlights new tools used, what has been successful and how they would change their product, together with a drawing of their finished piece of work. This then goes into their portfolio. The evaluation sheet has been introduced in Key Stage 2 and will be completed at the end of each project. This should help to focus children's thoughts on the processes and designs involved in DMAs, even if the materials are different. It will also provide an ongoing record of D&T work covered by the children, and something which they can refer back to. It is at this point that we feel the need to develop some sort of staff record sheet for design and technology.

Some differentiation has naturally been necessary for all children to succeed. Often this has been by outcome and expectation, particularly at the design stage in order for realistic designs to be achieved. It has had to be stressed that a simple achievable design must be produced for a quality product to be made. (We feel the need to do this at this stage, but hopefully in years to come, the children will see this as a natural part of the design process and that then more complex designs will be attempted). Extra support has been needed by some children in order for success to be achieved – not always incidentally by the MLD children. Support has been given by peers, as well as adults. The children see these activities as providing them with an opportunity to work together and help and motivate each other. It has been necessary sometimes to change materials and tools in order for success to be achieved. (eg. using running stitch instead of backstitch when joining pieces of fabric). The units of work give flexibility for this type of differentiation.

Future

Whilst we are pleased with the start made on developing design and technology in the school, we are aware that we still have a long way to go. We need to focus on further development of the units of work and build up collections and resources to help to support the teaching in school. The co-ordinator has recently attended a GEST funded course at U.C.E which was very helpful in developing understanding and skills. She now feels more confident in being able to help other members of staff with any queries and has had access to additional resources and tools. We feel that In-service support for staff is needed and we also would like to look at the new units of work introduced by DATA which in the future we could introduce to keep staff interest high, giving them alternative projects as a change. We also need to develop our record keeping and assessment strategies.



'Starting from Scratch' has been difficult for staff and children, but twelve months down the road we can see the benefits of using a structured set of guidance materials. Staff confidence is improving and the children's skills are developing considerably. More importantly, children and staff are starting to enjoy design and technology – not seeing it just as junk modelling or that lesson you could miss this week!

Above – A Completed Key Stage Two Evaluation Sheet

CASE STUDY 6

Design and Technology and Children with Severe Learning Difficulties

Old Park Special School, Corbyn Road, Dudley, West Midlands, England. Telephone +44 1384 818905

Sue Byers – Design and Technology Co-ordinator

Background

I teach at an all age Special School for students with severe learning difficulties in Dudley, West Midlands. The students start their education in the nursery unit at three years of age and leave school at nineteen. All the students follow the National Curriculum as much as possible and develop skills to facilitate some level of independence.

I have been teaching for 22 years and currently hold a post of responsibility for design and technology throughout the school. As part of my responsibility I have developed a scheme of work for D&T. The school policy is to develop the National Curriculum subjects through topic work, so therefore the D&T policy document I have developed is based on the six topics that the school covers bi-annually. These are Water, Myself, Animals, Environment, Leisure and Transport. Our Design and Technology curriculum is designed so that the students in the school will cover all six material areas recommended by the National Curriculum during the year. These are paper and card, textiles, mouldable materials, food, construction kits, reclaimed material and wood. The design and technology is delivered to the students by their class teacher and within each topic the teacher is given the flexibility to visit a specific material area more than once.

This case study shows how I developed the design and making skills through the topic of water. I decided to cover the material areas of paper and card, textiles, mouldable materials and reclaimed materials within interrelated activities. I currently teach a group of nine Key Stage 2 students (aged 8-9). They are a group with very mixed abilities including a variety of behavioural problems. Four of the students have meaningful verbal communication, the others all find it difficult to communicate and their levels of understanding vary considerably. I have full time nursery nurse support with this group.

We began the topic by talking about 'water' and the students who could communicate showed an interest in fish. We then went to the school library and found some books and pictures relating to fish and the sea. I then showed the students a film sequence available on the computer and we looked at different types of fish on a CD-ROM.

The students then produced their own drawing of a fish on paper. They all required some degree of verbal prompt and the least able students needed help with their basic fish shape. All this information was then transferred onto their planning sheets. As a group we talked about colours of the sea and they decided that they wanted to work in blues and greens. Then I introduced them to Press Print, this is very thin polystyrene which a design can be pressed into using a pen or pencil.

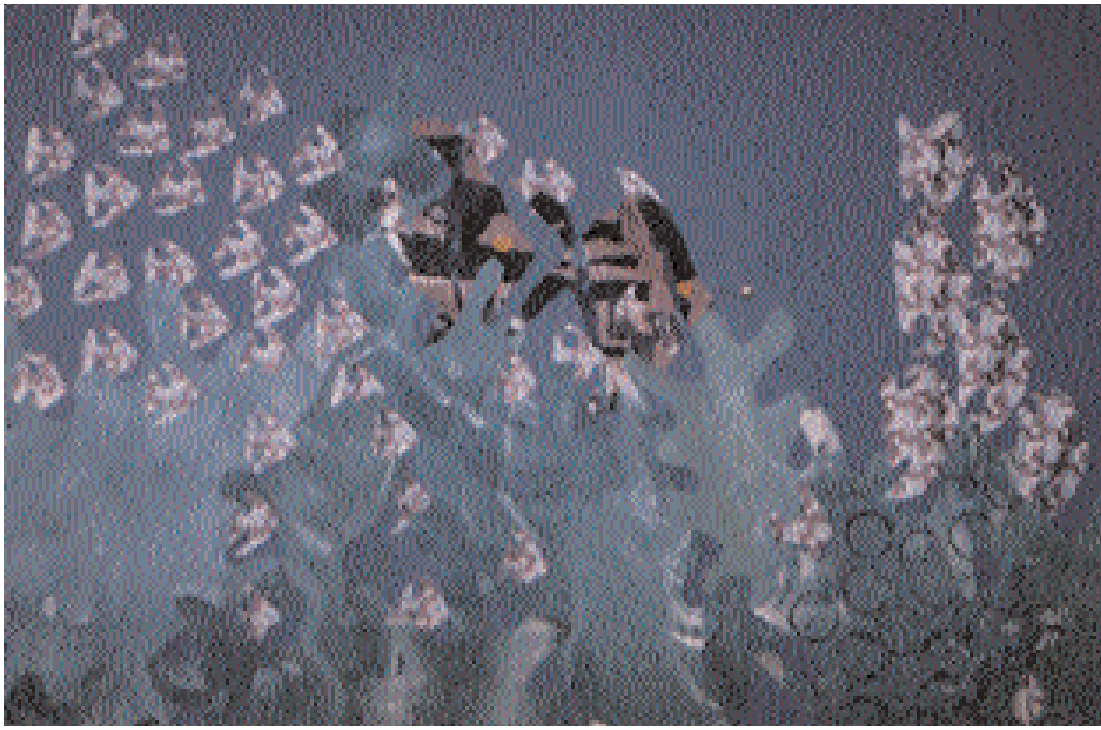
They copied their original designs onto the Press Print and then using different coloured Flexiprint transferred their designs onto paper and fabric. The students were grouped by ability. The less able worked with the nursery nurse who helped them to transfer their fish designs onto the two media. I worked with the more able who could transfer their designs by themselves but they all needed help to position the Press Print accurately. They all enjoyed using the paint rollers especially as it was quite a 'messy' activity. It was a pleasure to see their response to lifting the Press Print away from the paper to reveal their designs in colour. We experimented with mixing colours using ready mixed paint and the palette of colours on the computer. They produced sheets of patterns that I later cut out into fish shapes and seaweed to create a classroom display. The students chose where to position the cut out items.

This covered the paper and card module of the D&T curriculum and started the textile strand. As a group we looked at the Press Print the students had made on the fabric, and decided to frame them as individual pictures. I brought in a selection of decorated frames from home which included one that was decorated with buttons. The students all liked this particular frame so we decided to copy the idea. I made some thick card frames and the students decorated them using a selection of buttons. They then displayed their fabric print in a frame.

We continued with the textile strand by borrowing a 'heat press' from Dudley Local Education Advisory Service. The students transferred their design again this time onto wrapping paper after reducing their fish on the school photocopier. We had to help them to cut out their fish and then they positioned them face down onto a T-shirt. This activity took place in a separate room on a one to one basis due to the health and safety issues involved.

Finally we made a mobile. We were given a selection of stuffed fabric fish. Each student decorated a fish with a variety of materials including ribbon, sequins and beads using glue as a fixative. We discussed how things could be suspended and decided on a coathanger and two pieces of wood. Once the fish were attached we decided to add some sea weed to enhance the effect. I decided that this was a suitable theme to develop in the

mouldable strand of D&T. So the students transferred their fish design again, this time onto clay. The nursery nurse worked with three of the students to produce a joint piece of work. The others were able to produce individual tiles. They all needed help to roll out the clay as this was a medium the students had not used before. The fish shapes were cut out using cutting tools. They all required either verbal or physical prompts to complete this activity as they found it difficult to manipulate the tools correctly. While we were talking about labelling the students fish, so that we knew which one belonged to whom, one of the students picked up the idea and wanted to put her name on the front. The nursery nurse told the group that her own daughter had made a name plaque for her bedroom door at home so we decided to make our fish into name plaques. I brought into the lesson the following week a set of small alphabet cutters, the students found the letters for their own names and pushed them into the clay and added extra decoration using a variety of printing devices. They were then fired and glazed using a variety of colours.



Our last activity was to use reclaimed materials to produce fish with a moving tail. We began by looking at how simple levers work. The students again transferred their original design onto reclaimed cardboard boxes. With varying levels of success all the student attempted to cut out their shape with a Stanley blade. Obviously this was completed on a one to one basis. The group decided that they wanted the tail to move, so we cut this off to separate it from the body. The next task was to drill a small hole in two lolly sticks. All the students were excited at the prospect of using a 'real' drill (hand powered) and coped extremely well with very little assistance. They assembled the mechanism using brass fasteners and masking tape. They were overjoyed with the fact that their fish tails could move and showed them to everybody! They then decorated the fronts with textured paint and glitters.

This completed a terms work, the strands of food and construction were not covered as part of this topic but were delivered during the term. The students were extremely proud of their work which was displayed in the classroom and enjoyed showing it off to other students, visitors and staff.

I was very pleased with the way the project developed from a simple design. The students were introduced to new techniques and procedures and developed skills and pride in their work. Members of the group worked well together and communicated not only with each other but with staff about their work. They were all able to express and develop their own ideas through the many activities we undertook. I hope that this case study might inspire the reader to undertake a similar project for themselves.

CASE STUDY 7

Taro and the Turtle – A Design Technology Quality Experience

Four Dwellings Infant School, Quinton Road West, Birmingham, England. Telephone +44 121 422 3878

Sandra Walton – Headteacher. Anita Lucas – Design and Technology Co-ordinator

Background

Four Dwellings Infant school is an outer-ring school in Quinton, Birmingham. It currently has 241 pupils on roll all aged between 4 and 7, and has 92 part-time nursery places. Both staff and pupils at the school are enthusiastic about design and technology and are committed to producing work of a consistently high standard. We are always looking for new and exciting ways of presenting work to our children.

It was against this background that in October 1996 we were privileged to have the opportunity through the International Internship Programme to have a Japanese student, Kaoru Kimura, join our school on placement for nine months. In order to maximise this exciting opportunity we decided to enhance our curriculum by involving the whole school in a cross-curricular project focusing on Japanese culture. As part of this children, staff and the wider community have had opportunities to develop skills in origami, calligraphy and Ikebana as well as experience the intricacies of traditional Japanese Arts. This has led to a truly Japanese feel to the school with spectacular displays to which every child has contributed. As part of her teaching programme Kaoru has shared with us many stories from Japan. A particular favourite was a traditional Japanese folk tale Taro and the Turtle – Urashimatoro – and it was decided to use this with our Year 1 children (aged 5 & 6) as a focus for cross-cultural work.

We thought carefully about how we wished to use this story with the children. We felt it was important that the work the children were to be engaged in should remain relevant to their own lives even though the story itself came from a very different culture to their own. We therefore decided to build upon a successful design and technology week which we had held in October 1996. The theme for that week had been 'puppets' and we felt that by telling the story of Taro and the Turtle by using a variety of puppets we could form an appropriate link between the two cultures. We began by researching Japanese puppetry, thereby making this a learning experience for us all. However we found that we needed a puppeteer to work with us and so we approached 'Artists and Teachers Working Together' where we made a bid for, and were successful in gaining, a grant towards our project. We were able to commission Caz Frost to work for one week with our three Year 1 classes from December 9th – 13th 1996. We hoped that by the end of the week we would be able to deliver a performance of Taro and the Turtle using Japanese Bunraku, shadow and origami puppets – all made by our children.

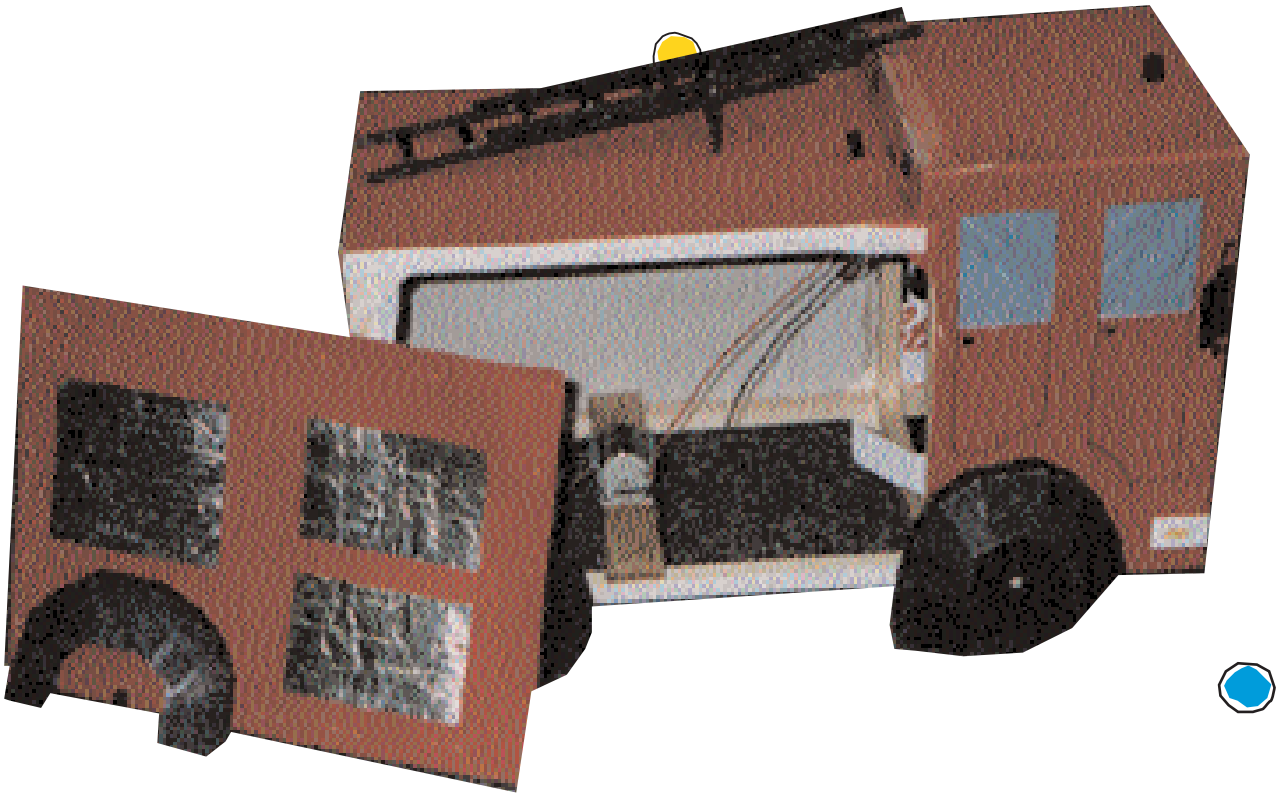
The Aims of the project were:

- to develop a community arts project that would promote cross-cultural understanding for all
- to support the delivery of the National Curriculum and to promote good practise in the arts.
- to support the development of design and technology.
- to provide 'hands-on' experience of Japanese culture and widen the children's world awareness.
- to raise self-esteem and promote enjoyment for everyone.

The project was to be a celebration of our whole school focus on Japan. It was planned collaboratively between the children, teachers – including the art and D&T co-ordinators – Caz Frost and Kaoru. At the initial planning meeting it was felt that since the children, staff and parents had already been exploring a wide range of Japanese themes using Kaoru's visit as a stimulus, that these should be developed further throughout the project. We felt that it was important that from the outset the children should have a degree of ownership of the story. Therefore at the initial bilingual reading of the story in late November there was no ending given. The children had to predict their own endings and these were then collated by Caz who managed, by the time December 9th arrived, to incorporate many of the children's ideas to give a Four Dwellings Infant School ending to the story. This proved to be most successful and was a wonderful stimulus to the beginning of the project.

At subsequent planning meetings the form of the project became clear. All the Year 1 children were to be involved in specific areas of the production. Caz was to work primarily with one class plus representatives from the other two classes. These children were to produce Bunraku and shadow puppets in the Japanese style. Another class was to produce the story-board and the last class, working with Kaoru, were to produce giant origami bird puppets. All the children were to design and make their own puppets for the crowd scenes. The resources needed for a puppet production on this scale were substantial. However, with a considerable amount of ingenuity all the resources were obtained at what was considered to be a reasonable cost. Despite careful planning and resourcing, the teachers involved felt slightly apprehensive as December 9th approached – how, we wondered, could we possibly produce a quality performance for children, parents, governors and friends in such a short time? We need not have worried. Caz reassured us in such a calm and confident manner that we began to feel that anything was possible!

Monday December 9th arrived – the beginning of our intensive week with Caz. To begin the day all the children were gathered together for physical exercises – a routine which was then established throughout the week. Karou led us in these and soon all the children began to absorb and enjoy Japanese culture. As the week progressed physical exercise was combined with vocal exercises to develop the different voice skills needed for the performance at the end of the week. The children were thrilled by the ending Caz had given to the story and soon they began to develop an empathy with the main characters. The children enjoyed researching the types of characters which were appropriate to the story and very soon the designing and making



process was begun. Kaoru and Caz acted as consultants during the making process and offered ideas and guidance to staff and pupils alike. The precise planning meant that everyone was clear as to what their part in the project was to be

Caz was able to give the children demonstrations using different puppets. These showed clearly the different types of movement that could be created. This enabled the children to make choices during the making process. Time constraints led to some activities being teacher directed. However, the children experienced many different skills and learnt so many new techniques during the week, that this was seen as a very positive outcome especially since many children have latterly used this knowledge in their design and making both at school and at home. The way in which six bright yellow foam footballs were transformed into Bunraku puppets was truly amazing! It was a privilege to watch the faces of the children as they made their origami bird puppets. They had sat in awed silence as Kaoru demonstrated her wonderful origami skills to produce the large flying birds. The children were then able to use their previous knowledge of origami on a much larger scale. It proved to be a most popular, successful and worthwhile experience for everyone concerned.

During the week the staff and pupils were engaged in many forseen and even more unforseen problem-solving activities. However, through discussion and the use of many prototypes all our difficulties were overcome – not least the method of fixing the dowel to the origami birds to allow them to fly!

The story was practiced as each set of puppets was completed and the children quickly began to assume the roles of the different characters. Since the Bunraku puppets were to be used as the lead characters in the story it was hoped that these would be completed as quickly as possible. However problems arose with glue that wouldn't dry and material that assumed opaque properties and this led to these puppets being amongst the last to be finished. However, as in any crisis, the children rose to the occasion and demonstrated remarkable co-operative skills to quickly learn how to move the puppets effectively. Finally, by Friday morning (Day5) all the puppets were completed and the planned performance of Taro and the Turtle – as told through story and Japanese puppets – took place. The performance exceeded all our expectations and reflected the valuable contribution and hard work of everyone who had been involved.

After the performance everyone felt tired but exhilarated. The standard achieved by the children and the knowledge and skills gained by everyone were enormous. Everyone had achieved so much in only five days. The Japanese focus was consolidated and developed and led to further cross-cultural understanding for us all. Every child took part in the project – designing, making and showing their puppets. Our key aims had all been fully met and surpassed. We are already looking forward to our next quality design and technology project.

CASE STUDY 8

Raising Achievement of Boys and Girls in Design and Technology and Information Technology

Elm Bank Teachers' Centre, Mile Lane, Coventry, England. E-mail pauline@citas.demon.co.uk

Pauline Burton – Adviser for Technology. Val Millman – Adviser for Equal Opportunities

Introduction

The project was led by the Support and Advisory Service's Technology and Equal Opportunities Teams who worked in partnership with Coventry Education Business Partnership Centres and Allesley Hall Primary School. The project was supported by local business and parents from the school:

- *Allesley Hall Primary School – pupils, parents, teachers, and support staff*
- *Coventry Education Support and Advisory Service – Equal Opportunities*
- *Technology and Careers teams*
- *Cheylesmore Partnership Centre (Construction Industry Training Board)*
- *Peugeot Partnership Centre*
- *Massey Ferguson Partnership Centre*
- *Rover Partnership Centre*
- *The National Grid Company plc*
- *Nastech Europe Ltd*
- *Coventry Technical College*
- *Ryton Gardens*
- *F. Russell & Sons, Baginton Bridge Nurseries*
- *Ove Arup & Partners, Consultant Engineers*
- *Coventry Quality Careers Services Ltd.*

Project Aims

The aims of the project were to:

- identify strategies for implementing the school equal opportunities policy within the information technology and design technology curriculum
- motivate year 5 and 6 pupils' interest in technology, and address the particular needs of boys and girls across the technology curriculum
- raise pupils' awareness of how technology will impact on their adult lives including employment opportunities
- raise teachers' awareness of issues and approaches that can raise achievement levels of girls and boys in technology
- identify approaches that could be replicated in other schools.

Project Management

Project management involved:

- planning
- implementation
- evaluation
- de-briefing
- review.

While the Technology adviser and the Equal Opportunities adviser took overall responsibility for project management, aspects of the management process were undertaken by different people in different places at different times. Sixty adults and forty seven pupils participated in the project in a variety of ways so regular and effective communication and clear roles and responsibilities were therefore vital elements of successful project management within an overall framework of agreed aims and methods. Management and co-ordination strategies included:

- Establishing a project team
- Training sessions for the project team
- Planning, co-ordinating and review meetings with the project team
- Preparatory visits and one-off meetings with those most closely involved in implementation
- Regular communication with all adults and pupils involved.

The Project Week

It was agreed that the most effective way to meet the project aims and in particular to motivate pupils interest in technology would be through a designated block of time. This would enable pupils to engage in a sustained piece of work which placed their learning in the context of the world of work. It was also agreed that where ever possible activities should take place off the school site as this would:

- raise pupils' awareness of how technology will impact on their adult lives including employment opportunities
- extend the curriculum by providing opportunities that are not normally available in school and
- provide opportunities for pupils to work with a range of adults other than teachers.

The major focus of the project was therefore the design and implementation of a week of activities that the school could build on throughout the year. The work represented the schools allocation of time to technology for the Autumn Term.

It was important therefore that the project week:

- was integral to the work of the pilot school and supported their policies for design & technology, information technology and equal opportunities;
- was an integral part of the planned curriculum for D&T & IT in the pilot school.
- included activities that enhanced the curriculum for D&T and IT through the development of new knowledge and skills whilst building on the previous work that the pupils had undertaken.
- was designed to address those aspects of technology teaching that research shows contribute to differential achievement of girls and boys by offering opportunities for:
  - working with single sex and mixed sex groups;
  - considering the relevance and impact of technology on girls and boys (womens and mens) lives;
  - using a range of classroom and resource management techniques;
  - providing a range of curriculum content and learning

experiences that target girls' and boys' learning needs and draw on their preferred learning styles

Early planning involved matching the requirements of the curriculum for design & technology and information technology with our objectives for raising the achievement of boys and girls and then identifying appropriate sites in which the work could take place. It was also important that the pupils should experience coherence across the range of different activities at different sites throughout the week.

Technology Project Week

Theme for the Week – Gardens and Garden Products

Monday – 4th November 1996

During the first day pupils were introduced to the work of designers and manufacturers from the world of work. The intention was that pupils should draw on these experiences in their roles of designers & makers later in the week.

1 They worked with designers of cars from Rover or designers of bridges at Ove Arup.
2 They saw manufacturing at the production line at Massey Ferguson or at Peugeot.

Tuesday – 5th November 1996

Tuesday was a day of focused practical tasks designed to extend the pupils' repertoire of knowledge & skills and to meet the planned learning objectives of the school. The intention was that pupils would use their knowledge and skills to help them to design and make products later in the week. The work took place at the Partnership Centres or on the Technology Bus.

1 They worked with wood to make products like plant holders or wind gauges
2 They used computers to help them make products like bookmarks, gift cards and key rings (CAD/CAM).

Wednesday/Thursday – 6th/7th November 1996

During these two days pupils worked in small teams. Each team completed a 'commission' to design and make products for the garden or gifts for the gardener.

1 On Wednesday they were 'designers' and in the morning visited Russell's Garden Centre or Ryton Gardens to carry out research to help them to develop ideas for their products
2 In the afternoon they worked in their design teams, at the Partnership Centres or on the Technology Bus. They were developing and trying out their ideas and producing prototypes or models
3 On Thursday they worked as a production team to 'manufacture' the product that they had designed. These included:
   – a bird table
   – printed gift cards*
   – embroidered gift cards*
   – printed bookmarks*
   – electronic gauge to test moisture content of soil of pot plants
   – key rings with Christmas tree fob*
   – key rings with printed fob*

   *mass produced and sold at project assembly.

Friday – 8th November 1996

On the last day of the project the focus was on the use of Information Technology. The purpose was to extend the IT skills the pupils had developed in school.

1 They visited the National Grid or Nastech Europe to see the way in which computers are used in the world of work.
2 They worked in the IT suite at the teachers centre and in teams used computers to combine pictures, sound and text and produce a 'multi-media' presentation of some of the activities they had enjoyed during the week.

Evaluation findings

Project evaluation was undertaken by project staff as well as by outside observers. Evaluation data included:

- reports from structured observations
- records of discussion with pupils
- outcomes of review meetings with the project team and school staff

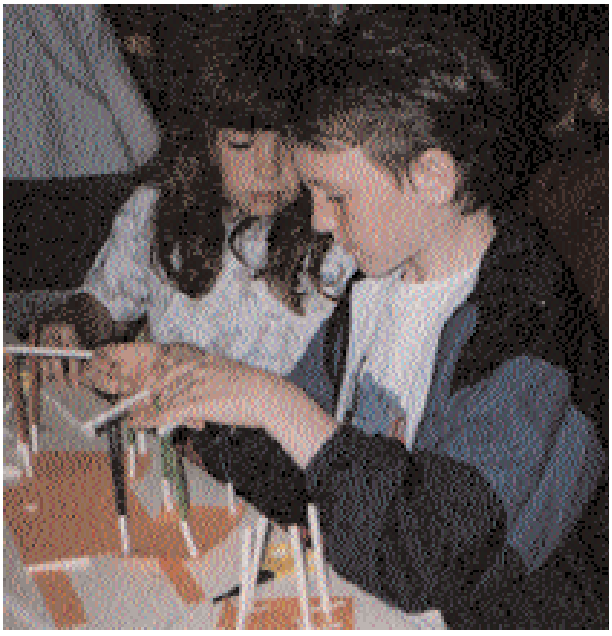
- written comments received from parents participating in the project.

The full range of evaluation data collected before, during and after the week was collated and analysed in three ways:

1 Data relating to each project week activity
2 Data relating to overall project aims and objectives
3 Data relating to planning and organisational issue.

The data relating to each project activity has been used to review individual components of future programmes. The findings relating to overall project aims are summarised below:

- Motivating pupils' interest in D&T and IT
- Blocked unit enabled pupils to see tasks through to completion
- Wide range of adults using technology in the workplace helped put school technology in relevant context
- First-hand experience helped eg. of people using technical language in everyday way
- Success increased motivation, eg. on completion of product, on sale of product
- Use of new materials and techniques with specialist tools and facilities excited pupils
- New experiences increased dialogue with parents at end of each day
- Pupils were able to relate some of own experiences with IT to what they saw
- Understanding the process of Designing and Making and the relationship between the different parts
- Pupils gradually showed increased understanding of relationship between different parts of the process and were beginning to look at design and make processes more critically
- Pupils could see that products were designed for a real purpose to be used by real people; high quality was therefore very important
- Pupils saw the importance of modification; of testing, trialling and developing a prototype
- Seeing the ideas of their team turned into products and sold was an important way of learning about the different roles different people play in the process
- Pupils demonstrated increased understanding of the role of the designer, the skills/processes used and different forms of manufacture
- Using technical vocabulary appropriately
- Pupils were quickly able to use new technical words when talking about their work; new vocabulary needs regular re-inforcement
- Awareness of impact of technology on adult lives
- Women and men using computers provided good role models; pupils had access to men and women managers. But men on the track and male senior managers re-inforced some stereotypes
- Widespread use of IT across project week made a big impact on pupils



- Pupils showed interest in and increased awareness of health and safety issues associated with technology
- Working independently/co-operatively
- Pupils who had previously learnt in school how to work in a variety of individual and group settings were best able to apply those skills to the project activities
- Careful grouping of pupils according to each activity's learning objectives maximised learning
- Carefully structured activities helped pupils working together for the first time
- Pupils learnt how to work in teams for a range of purposes in a range of contexts; individual pupils undertook a range of different roles
- Both single sex and mixed groups were effective, depending on the task. In some mixed groups, pupils divided into single sex pairs
- Pupils showed perseverance and determination in the face of technological and personal challenges
- High expectations, challenging tasks and considerable responsibility resulted in high quality pupil achievement including among the younger and less able pupils
- Pupils increasingly saw the value of listening to each others' ideas and finding ways of reaching consensus in relation to outcomes of market research or team decisions
- Pupils quickly learnt to relate to a range of different adults; this heightened their self esteem and self confidence
- Widening girls'/boys' repertoire of skills/techniques
- The range of situations extended boys' and girls' experiences and skills, especially through activities that could not be offered in school and which they might not otherwise experience out of school
- Deadlines, targets and time constraints of the workplace were helpful in stimulating effective teamwork

- Girls and boys showed new understanding, skills and interests; they were beginning to use new materials, tools and technical vocabulary with confidence
- Further work is needed to increase pupils' understanding of costing, estimating and pricing of products
- Both girls and boys showed increased confidence in learning from mistakes – girls need to be encouraged to move more quickly from planning to doing; boys need to be encouraged to rush into practical tasks less quickly and plan what is needed more systematically
- Raising adult awareness of gender issues
- Gender differences in learning outcomes were minimised through carefully structured tasks and groupings
- Varied questioning techniques, teaching and learning strategies were important
- Mixed and single sex groups were appropriate for different purposes; some pupils are less afraid to make mistakes in single sex groups
- Mixed pairs and mixed groups can successfully help girls and boys to work together if roles and ground rules are clearly established
- An increased understanding that teaching strategies and learning objectives must take account of gender issues if effective learning is to take place.

A three monthly and six monthly meeting has taken place with the school to review the impact of the project and the implications for their work. Involvement in the project has:

- led to a curriculum review to consider the organisation of design and technology and in particular the benefits of a block of time
- increased the awareness of the teachers involved of the process of designing and making and the need to share this with all staff in the school
- led to increased awareness of the gender issues and the need to consider the application of these to other subjects
- increased awareness of the benefits of access to outside agencies and additional activities have been planned to build on the project week
- raised the expectations of the capabilities of children of all ages leading to more challenging tasks in D&T and IT.

The Education Service is:

- using the outcome of the project to inform advice and guidance to schools;
- preparing a full project report for publication in the Autumn Term 1997. This will include a handbook that will support other schools who wish to consider a similar project;
- planning a programme of dissemination, training and support for other interested schools.

CASE STUDY 9

Stitching Together

Birmingham City Museum and Art Gallery, Birmingham, England.

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Eleanor Viegas – Community Museum Officer. Elaine Benbow – Senior Lecturer

Background

The Aston Hall Asian Women's Textile Group began in 1992, growing out of an MA dissertation about sharing culture through stitching. Since coming to Britain, Asian women tend neither to practise their textile skill, nor pass it down to the younger generation. Although they had produced fine examples of embroidered textiles, these had been made 20-30 years before, mostly for dowries. These skills are inherent in the culture of India, Pakistan and countries where women have settled such as Africa and the Philippines. With the availability of machine made garments, embroidery no longer forms an important part of their lives as it once did, and perhaps television and video have replaced the time spent on this traditional craft. However, for many women, embroidery remains a way of keeping in touch with their traditional heritage.

For the majority of Asian women religious belief plays an important part in their lives. Their traditions flow from the past into the present, and reality and myth are intermingled. The meeting of the spiritual with the physical is demonstrated in a practical way, and one helps the other to create a balanced life.

The group was set up to meet weekly in Aston Hall, a Jacobean house and one of the branch museums of Birmingham City Museum and Art Gallery. Funding was made available by West Midlands Arts and transport was made provided for the women by the Museum and Art Gallery. Aston Hall is in the heart of Birmingham's inner city. It is ideally placed for developing cross cultural themes, both because the local community has a strong multi ethnic make up and also the mix of European and Asian influence in the design of the building. Much high quality Jacobean work survives and the house is rich in plasterwork and carved wood and stone. The elaborate and dramatic decoration of the hall has provided much of the inspiration for the groups work. Similarities to Islamic decoration can be seen, particularly in the ceiling patterns which were taken from Turkish carpets imported to England in the 16th and 17th centuries.

Members of the Aston Hall Asian Womens Textile Group working in Aston Hall

When the workshops started the women found the building daunting and were hesitant about drawing. They needed help with selecting and simplifying details. A series of line drawings was produced by one of the group members with the assistance of a student who joined the workshop as part of a museum placement. These drawings are kept in plastic folders and the women work by tracing them on to the fabric. The same pattern has been used several times, but the individual choice of colours and stitches makes each piece very different.

The aims of the project are:

- To bring a section of the Asian community closer to the museum through the use of embroidered textiles as a vehicle for cultural integration.
- To provide opportunities for the women to pass on their skills both within the museum, schools and other community venues.
- To help keep alive traditional skills which are fast disappearing both in India and Pakistan due to the influence of western culture and change in lifestyle.

One example of the way these skills have been displayed can be seen in the Victoria and Albert Museum in London. This was called the Nehru Gallery Tent project and involved Asian women nationally and internationally in designing and making tent hangings which will be used to construct a Mughal tent in the garden of the museum from June to September 1997.

The women's new found confidence is taking them into schools and colleges to demonstrate their skill and they are beginning to value their cultural identity anew. Some of the women have indicated how much happier and healthier they feel since joining the group.

An example of the work undertaken by the group involved working as artists in residence at Aston Hall with children from primary and secondary schools. Using the building as a starting point, the children investigated designs through drawing which were developed into textile pieces.

More recently, the women have worked in schools alongside children and teachers. In one primary school, where 90% of the children were of Pakistani descent the children worked with the women in a similar way to produce a wall hanging inspired by the Victorian school building to celebrate the school's centenary. This project also involved the female members of their families helping to integrate them into school life and practise their embroidery skills.

Members of the group admiring their work at the Victoria and Albert Museum

Members of the group have also worked with students on art and design technology courses at the Faculty of Education at UCE. This two way relationship has enriched the programme offered at the faculty, through the teaching of specific skills and cultural interchange, bringing alive the university's mission statement on lifelong learning and equal opportunities. This has also given the women an opportunity to use the facilities available for textile work, experimenting with batik and printing as a base for their stitching.

The most recent work has involved members of the group in the ABC Internet project. The unique aspects of this project involved incorporating the new found skills of the teachers and children in using the computer to enhance their work as well as incorporating the skills of a local artist.The ABC project is based at the Faculty of education and involves 19 schools in Birmingham. In two of the primary schools children were working on the themes of materials in science and the Victorians in history. To bring together these two areas the work of William Morris was chosen as a focus to explore drawing, painting, printing, clay and textiles. The children used the Internet to down load information from the world wide web about William Morris and his work. Along with samples of designs from postcards, wrapping papers etc. the children explored his work by drawing. They developed designs which were used as a starting point for prints, clay tiles and a textile wall hanging. The children were able to communicate to their partner school how their work was developing through the Internet. One school has also displayed the children's work on their own world wide web pages – (http://www.abc-project.org.uk).

One of the members of the Textile group, Balbir, bought some samples of her embroidery into school for the children to look at and discuss. Many of the children were of Asian origin and could give examples of embroidered objects used at home, in clothing etc. Balbir helped the children to develop their own work through teaching particular stitches.

Experiences like these demonstrate how artists and craftworkers can make schemes of work in art and design and technology come alive by offering first hand opportunities to work alongside an experienced practitioner. Balbir was able to demonstrate new skills as well as initiating children into a process of working based on careful designing, working and re-working and evaluating. The wide range of her work decorating clothing, cushions, wallhangings etc showed how versatile her skills could be and how the art of embroidery can be used for a variety of artistic and technological projects.

The National Curriculum orders for design and technology and art specifically mention textiles as a material to explore in the Primary school. This has implications for schools in organising suitable activities and tracking the development of skills in both subjects. Because of the similarities in the subjects, art and technology are often closely related and sometimes taught together. A theme organised in the manner described above that integrates both aspects leads to a more comprehensive coverage of subject matter that compliments other curriculum areas. There is a need however for teachers planning this type of unit of work to consider how the outcomes are specifically art or technology based.

The process of designing and making is common to both subjects and much can be learned by working alongside artists in the way described here. Artists can play an important role in demonstrating to children how their designs are made, where their ideas come from and how drawing and sketching as well as using the work of other artists informs their working process. In art, designs can be used to develop decorative textile work, while in design and technology children are required to decorate textiles and then use these to design a more utilitarian object. In both cases the children are required to learn about fabric decoration and methods of stitching to join and embellish the work. This is the common area for both subjects and it is important that children systematically learn these skills to develop work in art and design and technology. Teachers in primary schools need to consider how they will teach these specific skills and create opportunities for different out comes. As part of a structured

Nursery/reception
• Sorting threads and fabric by texture, colour, pattern etc.
• Dressing up and identifying textiles in the environment
• Looking at the patterns and designs on clothes, cushions etc.
• Making a collection of different fabrics eg. soft, red, flower patterns etc.
• Joining two or more threads by tying
• Lacing and weaving into chicken wire, netting etc.
• Tactile or textile pictures

Year 1
• Simple sewing eg. running stitch
• Plaiting
• Looking at made and natural fibres and fabrics
• Weaving using warp and weft
• Print on to fabric
• Use fabric to make collages

Year 2
• More stitches eg. cross stitch
• Colouring fabric with natural and made dyes, felt tipped pens, bleaching with lemon juice
• Simple knitting
• Produce a class wall hanging by sticking and/or sewing. Use drawing as a starting point

Year 3
• Extend range of stitches eg. blanket stitch
• Produce simple three dimensional objects eg. puppets or toys
• Print on to fabric one or two colours using pressprint or card blocks
• Simple screen printing
• Work into prints with threads and fabric collage

Year 4
• Pleating and padding to give depth to pictures and designs
• Look at the work of textile artists
• Change fabric structure eg. take threads out of hessian and replace with embroidery thread
• More knitting stitches
• More sewing stitches
• Work back into tie dye
• Look at clothing in different periods and cultures

Year 5
• Create own fabrics by weaving, knitting, tie dye, printing etc. and make into a simple object eg. a bag, cushion etc.
• Use batik
• Work back into printing, batik etc. with fabric felt tipped pens, paints etc.
• Look at work from different cultures
• Use artists work as an inspiration for weaving, sewing and fabric collage

Year 6
• Work to a design brief eg. make a puppet and clothe it
• Design prior to making demonstrating knowledge of intended outcome
• Know about knitting machines, sewing machines, computer aided work
• Make a piece of work incorporating several textile techniques.

A group of children visiting Aston Hall

programme teachers can enrich their programmes through finding suitable opportunities to work with artists and craftspeople. This could be through specific projects such as the making of a wall hanging for a specific purpose or an ongoing set of regular inputs to develop specific skills. Working with a group such as The Aston Hall Asian Women's Textile group will also give valuable opportunities to develop the hidden curriculum through social and cultural interaction.

The chart (left) showing textile progression has been used with initial teacher training students and teachers to demonstrate how skills can be systematically developed through the primary school. Alongside an efficient method of collecting evidence on attainment to track skill development, teachers can ensure that the required skills are taught and learned. In common with other subjects we need to be certain that one skill is built upon another to give confidence and help children to develop work of good quality.

Teachers may feel that their skills in this area are limited. This is not unusual as the emphasis on sewing has dwindled in society as a whole. One way of compensating for the lack of personal skills could be to invite into school artists, craftworkers or parents and friends who are able and willing to teach these skills.

Many children not only enjoy this type of work but may also develop it into some aspect of their future careers. It is vital that textile work, which has been acknowledged in both the art and design and technology documents as an important material is worked with in a sympathetic and exciting way to fully develop the expression, knowledge, skills and understanding of the children in our primary schools.

Children from City Road Junior School working on an embroidered hanging for their school centenary

CASE STUDY 10

Information Technology in Design and Technology

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Introduction

The two areas of Information Technology and Design and Technology have had a confusing relationship due in part to their original inclusion in the same National Curriculum document. Of late, they have become more autonomous, but in many people's eyes, the word Technology is synonymous with both IT and D&T.

However, there are many areas in which IT has a very important role to play in the D&T experience, although as identified in Pritchard (1997), the development of children's IT capability through the medium of design and technology is not being exploited by many teachers. Using a desktop publishing program to produce a poster is a common task in D&T, but it would be equally applicable in many other areas of the curriculum. We need to focus in on the particular skills that will be enhanced by the children using IT, but we also need to look at activities that lend themselves particularly well to design and technology.

This case study will look at particular groups of content-free software, many of which are outlined in DATA et al (1996), and identify where they can make a definite contribution to the teaching of design and technology in primary schools.

Designing Questionnaires

In design and technology it is important to undertake research to find out what products exist, and what other types of product consumers actually require. The designing, delivery and analysis of questionnaires is therefore a relevant and useful D&T activity.

One approach would be to hand write the questions, analyse the results manually and then draw graphs and charts illustrating the findings. However, in order to produce a better quality questionnaire and to speed up the analysis we could look at solutions involving IT.

A word-processed questionnaire would be adequate, perhaps making use of limited presentation features such as bold and italic text and indents. Children could also use one of the symbol fonts such as Wingdings to produce boxes for children to tick in order to indicate their preferences. An extension of this approach would be to use a desktop publishing product to enhance the quality of the questionnaire design further, making it more attractive, and hence making it more likely that people will be prepared to fill it in. The responses could then be analysed with the assistance of a database package, and graphical representations of the findings would be produced. An alternative approach would be that of using a purpose designed program to design and analyse questionnaires such as Junior Pinpoint. The advantage of such an approach is that the questionnaire itself becomes an integral part of the data inputting and the labels of the graphics are also related closely to the original questionnaire.

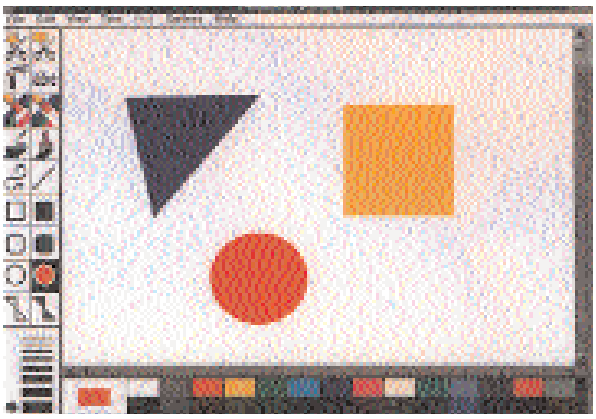
The different approaches that could be taken give opportunities for progression and evaluation to be built into this aspect of the childrens work.

Using Paint or Draw Packages

Drawings of different kinds are needed when engaging in design and technology activity. Sketches of ideas, design drawings showing how a particular feature will work, working drawings with dimensions and annotations to assist in the making process and presentation drawings of the finished product all require different skills and techniques. Important question to consider at this point are what are the features of the various packages available and why do we want children to create drawings on the computer anyway, rather than using more traditional media.

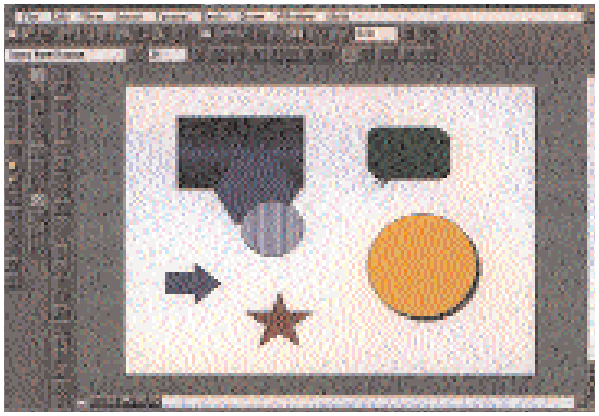
There are many actual drawing and paint programs commercially available but they are all basically either paint packages or draw packages.

Consider that a computer screen is made up of a grid of very small rectangles-they are actually called pixels. On a typical Windows computer the grid is 800 by 600 giving a total of 480,000 individual points. In a paint package you have a large number of features, which allows you to alter the colour of each of these pixels. These are called bitmapped images and because information about the colour of every pixel on the screen needs to be stored they tend to be made up of very large files. Any picture that is drawn in this way can therefore be edited by changing the colour of individual pixels. If pictures are scanned into a computer they are automatically converted to a bitmap format. A child could therefore draw a design using traditional media, then scan it in to a paint package and by using a series of tools to flip and rotate their own image, design a piece of wrapping paper which can actually be used to wrap up a Christmas present.



An example of a Paint Package

A drawing package stores the graphics images in an alternative form, basically as a series of mathematical equations. If you draw a square in a draw package the information that is stored consists of the size of the square, the position it occupies on the screen and its colour. If you draw a much larger square, the amount of information which has to be stored about the shape is very similar ie. size, position and colour. This means that the amount of storage space for drawing files is much less than that required for paint files.

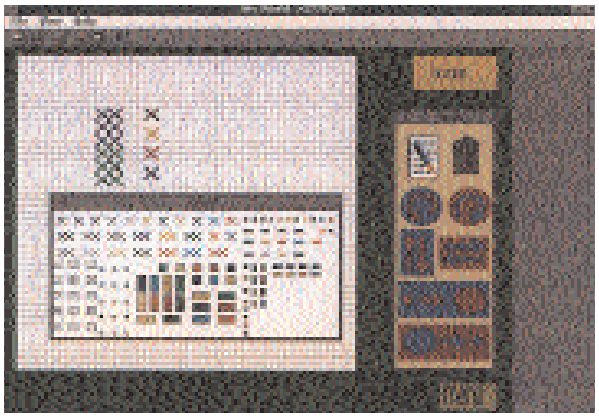


An example of a Draw Package

Draw packages also allow images to overlap on different layers, and each component of the drawing can be selected and edited separately giving considerable control over the finished product. It also means that when the image is enlarged, the values in the mathematical equation are increased proportionally and a clear image is still obtained – not one made up of jagged lines! This is the type of program to use when children are doing more technical drawings of their products.

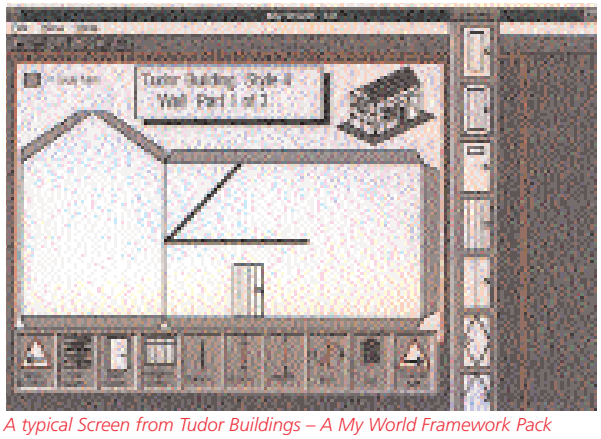
It should be noted that these packages do not make it easier to draw than when using traditional media – in fact in some cases, particularly when using a mouse to draw with, it is a much more difficult skill.

A useful way to introduce children to using the computer for drawing is to use a framework program, which although far more restrictive than true drawing packages, gives the children a limited number of facilities which can be used to produce good quality products. The 'My World – Textiles' pack for example allows you, amongst other things, to create a cross-stitch design, merely by clicking on the selected stitches in the bottom window and then clicking them in place on the simulation of the fabric.



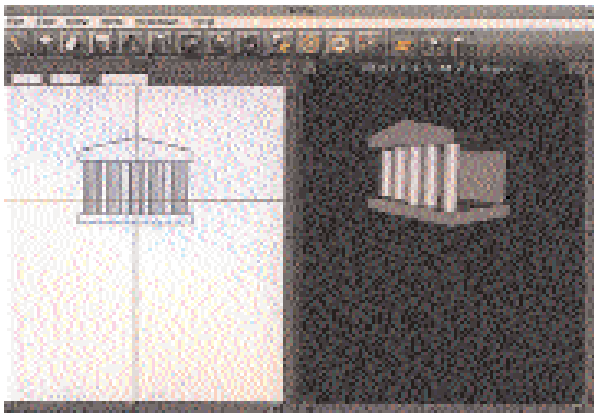
Textiles – A My World Pack useful for cross-stitch design

The 'My World-Design a 3-D Tudor Building' pack gives some basic Tudor buildings, and allows you to add beams, windows, doors and roof tiles to the basic model. These can then be printed out on card – the tabs are automatically included and made up to form a useful prototype of a Tudor home. The package is not as flexible as a drawing package, as the components can only be easily altered in size by fixed increments, and there are limited opportunities for actual design, but the structure which the program provides is useful in introducing children to this type of activity.

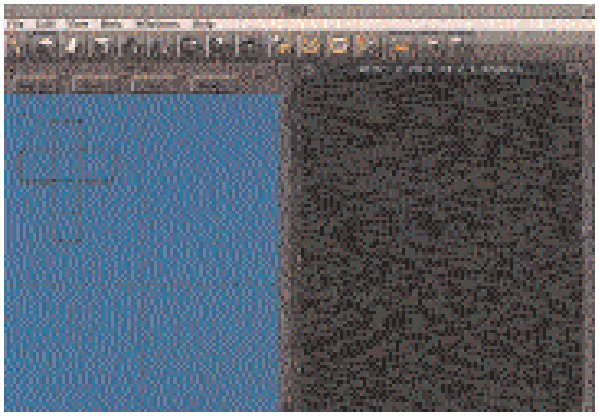


A typical Screen from Tudor Buildings – A My World Framework Pack

Children can then go on to use more open-ended drawing programs such as TABS+. The power of TABS+ is that whilst the drawing is produced in two-dimensions, a three-dimensional representation is automatically shown on the screen, and there is also the facility for nets to be produced for each design again with tabs added so that a cardboard prototype of the design can easily be made.

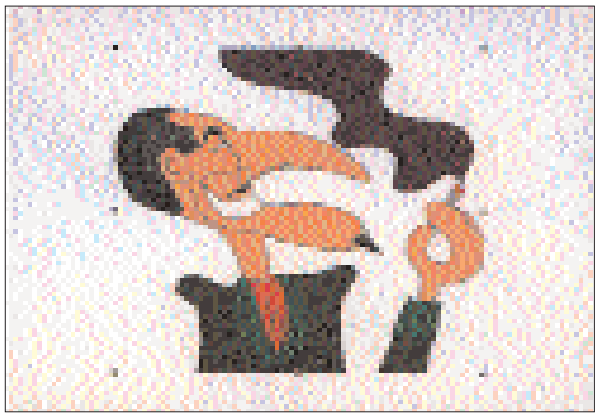


A screen from the computer aided drawing package TABS+

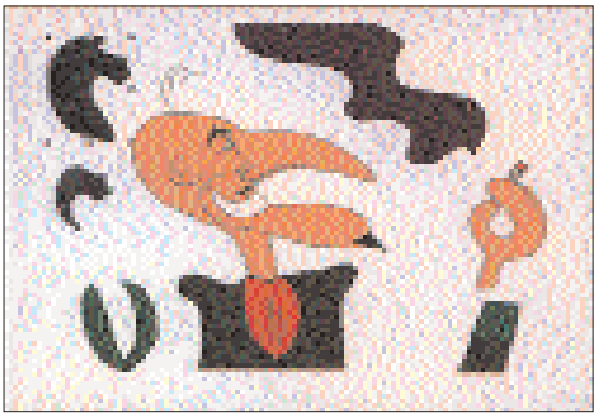


The TABS+ program showing 2D drawing and automatic net design

Clip-art pictures are generally draw objects rather than paint objects, so they can be edited using a draw package. This editing should be encouraged by children as they progress through their primary education.



A complete Clip-art image



A Clip-art Images has been "ungrouped" and edited

We should, however, beware of childrens' over reliance on clip-art products and their indiscriminate use. The ease with which images can be imported into publications should be mediated by an understanding by the children of the appropriateness of their use. There must also be plenty of encouragement for children to create their own original work using paint and draw packages.

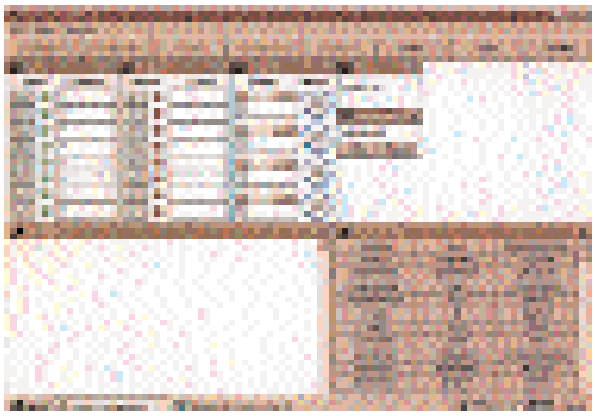
Clearly we must have clear ideas about why a child should be doing a drawing using a paint or draw package as opposed to using pencil, crayon, pastel or paint. The power of the computer must be utilised because it is appropriate, not simply because it is there. The overriding question we must continually ask is why are we asking children to use that particular program?

Controlling Models

Perhaps the closest link between IT and Design and Technology is in the field of control. It must be remembered that control and computer control are not one and the same thing, and that there are a whole range of control activities which can be undertaken which do not need computers. In fact an appropriate teaching strategy is to identify that much of control can be done manually, and it is only when the actions become very repetitive or more intricate that we need to look at ways of automating the process. This leads us on to the use of the computer.

The ubiquitous traffic lights are an excellent example of how this idea can be developed. A manual three way switch can easily simulate the red, red/amber, green, amber and red sequence of the British traffic light system. This, however, needs to be done 24 hours a day, so as it is so repetitive it benefits from automation. But the problem gets more complex when you consider that you also need traffic lights in the other direction at the cross-roads and that their sequence needs to be linked very carefully to the first set. When you consider the extra complexity involved if you are controlling a major road junction with pedestrian crossings as well, you can easily see the need for the use of some automated switching system – the kind that a computer is very good at.

Using some sort of visual programming, ensures that the principles of control do not get lost in the actual technicalities. A program like Co-Co for Windows has a very simple interface, which clearly explains what is going on the screen.



Co-Co

An activity of this type emphasises that all a computer is really used for is automatically switch devices on and off. Taking the ideas a little further will highlight the further sophistication of controlling the actual direction of motors and of using computer inputs to trigger particular actions. Again, this can be related to the traffic light simulation, where a vehicle driving up to a set of traffic lights on a minor road at night is detected by a sensor and allows the sequence to be triggered to allow that car to pass, before giving the traffic on the main road priority once again.

Once children are familiar with the process they should be able to control their own models using computers, if appropriate. An activity, which is ideally suited to this, would be if the children produce an interactive museum exhibit on a particular topic (Ager 1997). A small cardboard display stand could include models of lions on a turntable, a colour transparency of a photograph of a lion with a light behind it, a map of the world with light emitting diodes identifying the countries in which lions live, and a pressure pad near to the display which triggers the start of the sequence when someone approaches. You could even use the computer to switch on a battery-powered tape recorder, which would give some background information about lions. In sequence, the turntable would slowly rotate, the light would illuminate the photograph of the animal and the LED would indicate where in the world lions could be found. It is important to note that a product of this type does not have to be connected to a computer it will work very effectively with manual switches. This is important in terms of IT resources, as each model only needs to be computer-controlled for a few days you do not need a computer for each group.

As the power of computers increase, so will the sophistication of the software and the range of facilities, which they offer. Let us not be afraid to develop IT skills through focused practical tasks in the same way that we develop making and designing skills. And of course we can also use word processing for report writing and CD-ROM encyclopedias and the Internet for background and research information into D&T, as we do in all the other areas of the primary curriculum.

References

- Ager R (1997)
  Curriculum Bank – Design and Technology Key Stage Two
  Leamington Spa, Scholastic
- DATA / MAPE / NAAIDT / NCET (1996)
  Design and Technology – A Pupil Entitlement to IT at Key Stages 1 and 2
  Wellesbourne, DATA
- Pritchard A (1997)
  Supporting Childrens' Learning in Primary Design and Technology With Information Technology – some possibilities and some teacher perceptions
  The Journal of Design and Technology Education
  Volume 2 Number 2
  Wellesbourne, DATA

CASE STUDY 11

Primary Technology Education in Scottish Schools – Past, Present and Possibilities for the Future

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Denis Stewart – Director

Introduction

Pupils will be better equipped to live purposefully, productively, confidently and wisely in the world of today and tomorrow if they have been enabled to acquire a broadly based technological capability (Scottish CCC, 1996a, p.4).

This positive assertion in a recently published statement of position from Scottish CCC, entitled Technology Education in Scottish Schools, is an expression of the renewed sense of importance that is being attributed to technology education in both primary and secondary sectors of the education system in Scotland. The CCC's statement is the result of a fundamental review of technology education from 5 to 18, undertaken between 1993 and 1995. It has attracted positive comment from a wide variety of interests and received endorsement from the Secretary of State for Scotland as a basis for national policy and for further curriculum development nationally.

This paper provides a description of the way in which technology education from 5 to 18 has been re-conceptualised through CCC's review and indicates some implications of the new curriculum framework that has emerged for the ongoing development of primary technology education in particular. This account is contextualised by a brief survey of the origins and early history of technology education in the primary curriculum in Scotland, together with reference to findings of two research projects conducted in the period 1993-95 and to a current development programme.

The evolution of technology education in Scottish primary schools

As elsewhere in the UK, school technology education – and, in particular, primary school technology education – has a fairly short and chequered history. There seem's to have been few in any examples of explicit reference to 'technology' in the various primary science curriculum materials and development projects which impacted on schools from the late 60s to the mid 80s (Harlen, 1995). Even the government-funded Primary Science Development Project (1981-85), which was established to encourage many more primary schools to develop their own policy and practice in science education, does not refer to technology. There were, however, many examples of problem-solving activities in documents and materials on primary science produced during this period which would later come to be seen as technological in nature.

It was not until 1985, when the Committee on Technology set up by the Consultative Committee on the Curriculum published its report (CCC, 1985), that the recommendation was made that teachers in primary schools should be encouraged to introduce technological activities and should be supported in doing so by the provision of adequate resources (CCC, 1985, p.25). By 1985, a minority of primary schools were incorporating some form on technological learning experiences into their curricula. This process seems to have continued in a fairly 'patchy' manner throughout the remainder of the 80s and into the early 90s so that by 1993, the HMI Audit Unit report, Standards and Quality in Scottish Schools (SOED, 1993a), was able to report that technology featured significantly in the curricula of about two thirds of primary schools, although in only 45% was it judged that pupils were achieving good understanding in technology.

That same year saw the appearance of the national guidelines for Environmental Studies 5-14 (SOED, 1993b), which set out, for the first time in a national curriculum statement, a specification for technology education. As part of a cluster of subjects – science, social subjects and technology, together with health education and information technology – the 5-14 Environmental Studies guidelines set out two attainment outcomes for technology:

- Understanding and Using Technology in Society
- Understanding and Using the Design Process.

Gradually, primary schools in Scotland are turning their attention to technology education as part of a wider review of their provision for 'environmental studies'. And in this area of the 5-14 curriculum, as in some others, there is, generally speaking, much to be done yet in many schools.

Insights from recent research

Two very different research projects, conducted during the period immediately following the publication of the 5-14 Environmental Studies guidelines, shed some light on the promise and the problems of technology education in primary schools.

The first, a small-scale SOED-funded project, focused on effective innovations in four primary schools. The schools selected for the study could be said to have made a start with 'implementation' of the 5-14 guidelines and had exhibited, within that, a particular interest in making technology education a strong feature of their curriculum. The experiences of these schools provide encouraging insights into what is possible in relation to this important, yet largely underdeveloped, area of the primary curriculum. Thus, among the factors that were indicated to be important to the success of curriculum innovation in technology were (Scottish CCC, 1996b):

- the presence of at least one energetic enthusiast for technology among the teaching staff, combined with supportive and effective management by the headteacher;

- development of well thought out systems for organising and managing resources and work areas, which involve giving significant responsibility to pupils;
- acknowledgement and celebration of pupils' learning and achievements through attractive and interesting displays of children's work;
- making good use of the local environment and community, including local industries, to broaden and enhance pupils' perspective on technology in society;
- providing opportunities for pupils to work on practical tasks that involve creativity, enable children to think within a framework of design processes and are sustained by genuine interest.

Indications from the case studies were that technological activities in the curriculum can be enjoyable for both pupils and teachers and, at the same time, thoroughly beneficial to pupils' learning. For example, through their involvement in practical 'design-and-make' activities pupils appeared to develop more confidence. Some of those interviewed indicated that they had become less anxious about offering their own ideas to others, even though they knew that these ideas might not be accepted (Scottish CCC, 1996b).

The other, more comprehensive research project was concerned with primary teachers' perceptions of their own competence and confidence in technology. Not surprisingly, partly in view of findings of similar research in England (Bennett, 1992), technology seems to be the curricular area where primary teachers have least confidence regarding their subject knowledge, though they are confident about their generic pedagogical skills (Harlen, 1995). Of greater interest are the variations with respect to aspects of technology and the indications which this research provides regarding the reasons for lack of confidence. For example, teachers tend to be less confident about control technology or design processes than about social aspects of technology. But the lesser confidence regarding design processes, for example, may be due largely to lack of familiarity with design vocabulary.

Overall, the impression conveyed by the this research is that teachers' understanding of the nature of technology and of technology education is at least as important, if not more, than the extent and depth of their knowledge of particular technological concepts and processes (cf. Jones, 1997). Certainly, it was, in part, the perception that there appears to be no clear and generally shared view in schools about the nature and main purposes of technology education (Scottish CCC, 1996a) that the CCC's review was initiated to address.

Outcomes of the review of technology education

The review that Scottish CCC embarked upon during 1993 was conceived not as a critique of current provision from 5 to 18 but rather as an attempt to establish principles and perspectives which should underpin the further evolution of technology education in schools. The result was a statement of position from the Council (Scottish CCC, 1996a), central to which is a conceptual framework consisting of statements of principle about educational goals and the general characteristics of the curriculum needed to achieve these goals. Underlying these curriculum principles are a set of perspectives on the nature of technology, its place in human society and the value of technological learning as part of general education for every young person, irrespective of aspirations, aptitude, gender and social or cultural background. For example, the view of technology taken in the CCC position paper is that it is, first and foremost:

- a distinct form of creative activity in which human beings interact with their environment to bring about change in response to needs and wants.

Technology is regarded as a highly influential cultural phenomenon and important characteristic of all human societies which both reflects and shapes the values and beliefs of its wider cultural and social context. Technological activity is regarded as comprising designing, manufacturing, evaluating and other processes. It involves imaginative and enterprising application of knowledge and skills from a variety of disciplines or domains of human activity and striking compromises between apparently conflicting demands and constraints.

The value of technology education is described in the position paper in terms of a range of cultural, economic, educational, philosophical and social arguments. For example, technological learning helps to privilege the practical and can also do much to encourage moral thinking and social responsibility in people (Scottish CCC, 1996a, pp.4,5).

The core assertion in Technology Education in Scottish Schools is that technological capability, conceived in terms of four interconnected and mutually supportive aspects, should be the goal of technology education at every stage of schooling. This technological capability encompasses technological and other forms of knowledge and understanding of various concepts and processes. However, it is essentially about being able to apply resources of knowledge and skills by thinking and acting confidently, imaginatively, creatively and with sensitivity. Descriptors of the four aspects of technological capability are reproduced in the Table below (over).

Technological perspective
• By this is meant a way of seeing and thinking about the world (past, present and future), of reflecting on the effects of human interaction with the environment and of thinking imaginatively about better ways of doing things. Having a technological perspective means bringing an inquisitive mind to bear on the made world, being able to appreciate the complexity of decisions which may involve resolution of tensions between aesthetic, cultural, economic, ethical and functional aspects of product design, and being able to communicate technological ideas effectively.
Technological confidence
• In essence, this means being able to live and work confidently and constructively in contemporary society. Technological confidence includes knowing and valuing one's potential for positive action; being able to identify and tackle problems or issues; being able both to operate independently and to work in a team; being able to challenge the ideas and actions of others; being willing to take intellectual risks; being ready to persevere in the face of setbacks; and generally being prepared to take a positive and pro-active approach to a whole variety of practical and socially relevant activities.
Technological sensitivity
• By this is meant a caring and responsible disposition, a habit of mind which asks and reflects on questions about social, moral, aesthetic and environmental, as well as technical and economic, aspects of technological activity undertaken by oneself and others in a variety of contexts.
Technological creativity
• This includes an ability to design and/or make technological products of high quality or to modify existing products by selecting, organising and using available intellectual and material resources; an ability to evaluate, analyse, make thoughtful and imaginative decisions, give justification for actions and generally 'get things done'. The final section of Technology Education in Scottish Schools describes general characteristics of the educational provision which is necessary if technological capability is to be developed effectively. The paper emphasises students' entitlement to appropriately broad and varied programmes of learning experiences and presents some ideas about progression. It argues that students need to have opportunities for first-hand experience of engaging with creative practical tasks (CPTs) which involve designing, making and/or modifying technological products. Pupils' engagement with these CPTs needs to be supported by work on more focused tasks – called proficiency tasks – by which specific resources of skill and knowledge are developed. In addition, students' first-hand experience of CPTs needs to be complemented by adequate opportunities for case study tasks, ie. indirect studies of technology, its manifestations in the wider world and its interactions with society and the environment.

Table – Aspects of Technological Capability (from Scottish CCC, 1996a, pp.8,9)

Some implications for technology education in the primary stages

One of the problems with the current situation regarding school technology is that developments over the past decade or so have been such that it is difficult for schools to ensure coherence and sustained progression in pupils' technological learning from the early years right through to age 16 and beyond. The perspectives and principles in CCC's position paper provide a national framework which should help to achieve a more coherent and progressive technology education for all pupils. In primary schools this underlines, for example, the importance of planning technological learning experiences so that there is continuity from year to year and adequate opportunities for building on prior learning and achievements.

Technology Education in Scottish Schools also offers primary teachers a framework for thinking about the nature of technology and the goals and characteristics of appropriate and effective technology education. As a consequence the position paper should assist with the important process of making personal sense of the attainment outcomes, strands, targets and key features in the technology component of the Environmental Studies guidelines.

Also, bearing in mind the inter-disciplinary nature of technology in the wider world, the CCC position paper may help more primary teachers to see the integrative potential of technology in the curriculum and to discover through their own experience the value of engagement with technological tasks for developing children's confidence, creativity and critical thinking alongside their skills in use of language, in number and measurement, in manipulation and in working with others.

More specifically, the stipulation that technology education should reflect, as far as possible, the nature of technology in the wider world (Scottish CCC, p.11), has implications both for the 'content' of the curriculum and for the development of effective links and interactions between primary schools and the communities to which they relate, including local businesses and industries.

Supporting developments in primary technology education

The process of translating the perspectives and principles of Technology Education in Scottish Schools into effective practice in every primary classroom is a daunting one which will require sustained encouragement and support. To this end, CCC has established a Technology Education Development Programme (TEDP) with the intention that this should contribute, along with the various efforts of local authorities and others, to school-based developments over a period of several years. The TEDP has five strategic strands, each of which relates to curriculum development in both primary and secondary schools:

- to foster broader support for the ideas in the position paper, encouraging discussion and encouraging efforts to review and develop existing provision
- to exemplify ways in which Technology Education in Scottish Schools can be put into practice
- to support use of the position paper in initial teacher education and in In-service education and training
- to encourage and support production and/or adaptation of commercial learning and teaching materials which are compatible with the position paper
- to develop and support effective networks of teachers, advisers, teacher educators and others with an interest in technology education.

Towards the end of the TEDP's first year of operation, there are encouraging signs of positive developments in each of these areas, not least in the primary sector and in the form of collaborative ventures involving associated primary and secondary schools.

References

- Bennett SN, Wragg EC, Carre CG and Carter DSG (1992), A longitudinal study of primary teachers' perceived competence in, and concerns about, National Curriculum implementation Research Papers in Education, 7 (1), pp.53-78
- Consultative Committee on the Curriculum (1985) The Place of Technology in the Secondary Curriculum Dundee College of Education for the CCC
- Harlen W, Holroyd C and Byrne M (1995) Confidence and Understanding in Teaching Science and Technology in Primary Schools Edinburgh, Scottish Council for Educational Research
- Jones AT and Carr MD (1997) Towards a model for teacher development in technology education – from research to practice (forthcoming paper)
- Scottish CCC (1996a) Technology Education in Scottish Schools – A Statement of Position from Scottish CCC
- Scottish CCC (1996b) Environmental Studies 5-14 Exemplification – Technology Case Study
- SOED (1993a) Standards and Quality in Scottish Schools Edinburgh, Scottish Office
- SOED (1993b) Curriculum and Assessment in Scotland – National Guidelines: Environmental Studies 5-14 Edinburgh, Scottish Office

Notes

- Scottish CCC is the UK government's principal advisory body on the curriculum in Scotland.
- Council has a remit to keep the curriculum of schools in Scotland under review, to offer advice to the Secretary of State for Scotland and to issue guidance on the curriculum to local education authorities, schools and others
- A predecessor of the current Scottish Consultative Council on the Curriculum
- The notion of 'environmental studies' was first put forward in the 1960s in the Scottish Education Department's influential Primary Memorandum, Primary Education in Scotland (SED, 1965).
- The case studies formed part of an OECD project, Innovations in Mathematics, Science and Technology, and were conducted by Peter Kormylo, Headteacher of Loreburn Primary School in Dumfries. During his secondment, Peter Kormylo also worked as Development Officer for Scottish CCC's Technology Review Group (1993-94).
- Also SOED-funded and carried out by the Scottish Council for Research in Education (SCRE). A specification which is broadly congruent with the principles set out in CCC's position paper.

CASE STUDY 12

Design and Technology in the Primary Curriculum – The Nuffield Approach

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David Barlex – Executive Director

Introduction

Design and technology provides children with the opportunity to make decisions and take action. In the National Curriculum of England and Wales this decision making and action taking manifests itself through designing and making. The Orders (DFE 1995) focus on design and technology capability and have the following as their mission statement:

- *Pupils should be taught to develop their design & technology capability through combining their Designing and Making skills with Knowledge and understanding in order to design and make products.*

There is of course more to a design and technology education than designing and making and a closer inspection of the orders reveals opportunities for pupils to consider the relationship between technology and society and the effects that products have on the way we live. But there can be no doubt that the main emphasis for this area of the curriculum is on pupils designing and making and this presents a considerable challenge for the classroom teacher.

The Nuffield Foundation has funded, for one year in the first instance, a curriculum development project to explore the place and benefits of design and technology in the primary curriculum. Funding is earmarked for a further two years subject to favourable findings during the first year.

Five key questions

The Project is asking, and trying to answer, the following five questions through this curriculum development activity.

1 How can teachers ensure that pupils get better in D&T as they moves across KS1 and KS2?

The project believes that the answer lies in formulating a sequence of learning activities that make increasing demand as pupils get older with the important caveat that the activities are negotiable with pupils so that the demands can be adjusted according to the abilities of individual pupils. There are of course other criteria that these activities must meet. They must be stimulating and motivating for children, enjoyable for the teacher, manageable in the classroom, affordable, rich in links with other subjects, meet the requirements of the National Curriculum.

2 For a learning activity what are the teaching methods?

The Project has identified three key methods:

– Teaching through big tasks

These are usually designing and making assignments

– Teaching through small tasks

These are short activities that teach children the knowledge and skills they need to be successful with the big tasks

– Teaching through the use of stories

This is an established primary school technique, most teachers tell a story to their class every day. Using such stories as a stimulus or to provoke reflection will be an important strategy.

By using an appropriate balance of these methods the teacher can construct a powerful learning activity. By organising the sequence of these activities so that they become more demanding the teacher can achieve progression.

3 What sort of products should children design and make?

The Project believes that anything a child designs and makes should be worthwhile with a clear purpose. So far the Project has identified a range of different types of product for each media of designing and making. These types do not represent the only possibilities but they do provide a set of useful and varied starting points.

In resistant materials, structures and control

– designing and making a toy – either for the pupil him/herself or another child;

– designing and making a story prop' which must be suitable for both the story and the story teller;

– designing and making a small scale model to act as a prototype to explore the efficacy of particular design ideas.

In textiles

– the production of fabric (through weaving and felting);

– the decoration of fabric to be used in a simple product (through wax resist, tie dyeing, printing and appliqué);

– the production of garments and accessories.

In food

– a product produced by heating – bread toast;

– a product produced by extracting – hot tea;

– a product produced by peeling, cutting and combining – fruit salad;

– a product produced by weighing, combining and baking – jam tarts;

– a product produced by weighing, combining, raising and baking – bread.

IT activities

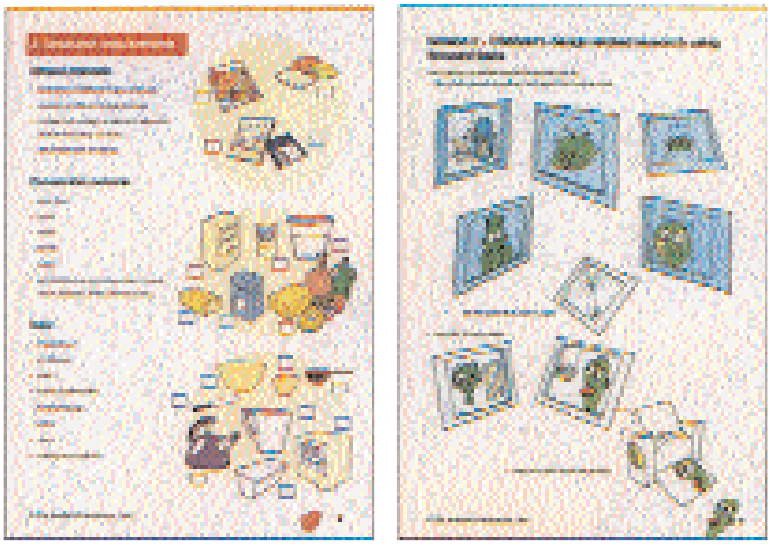
– Controlling movement using IT;

– Designing things you can't make using IT;

– Designing your own multimedia packages using IT;

– Designing things that you can make with the help of IT.

The Project is taking the view that product complexity is an important feature of progression in designing and making. The more complex the product the greater the knowledge, understanding and making skills required to design and make it. But it is not the only one and there are other important factors – the range of procedural skills that children bring to



Extracts from the Nuffield Primary D&T materials

bear on the designing and making, their understanding of the users needs and wants to be met by the product they are designing and making and their consideration of wider issues such as historical significance, sustainability, gender significance can all contribute to the demand of a designing and making assignment

4 **What about Products and applications?**

John Garvey is developing an interesting framework which can be used with a variety of different products. At the moment it looks like this:

Teacher information
- A series of annotated drawings giving the teacher useful and relevant information
- Resources
- Typical lesson requirements
- Core work

Using the product
- Was it easy to use?
- Did it work well?
- Would you want to have one like it at home?

Drawing the product and then
- Name the main parts
- Explain what each part is used for
- Explain how its shape helps it do this
- Explain how the parts are held together
- Name the materials used for each part
- State the properties of the material that are useful in helping the part do its job?
- State where each material comes from
- Try to explain how each part is made
- What will happen to each part when the product is thrown away?

Extension work
- Modelling the product
- Changing the product

Homework
- Finding the product at home
- Finding the product at the shops

- How much does it cost?

5 **How will the materials for teachers be structured and presented?**

Each activity will be presented as a booklet with the following structure:
- Typical outcomes
- The activity in terms of the big task, the small task, the stories
- Resource requirements
- Learning possibilities in D&T
- Learning possibilities in the wider curriculum
- Description of the activities on a session by session basis
- Children's design decisions
- Important vocabulary
- Technical advice
- Classroom management and assessment advice
- Appendices (Programme of study audits for:
  - D&T
  - Science
  - Maths
  - English
  - and other subjects.

The Trial Schools

Each of the authors is responsible for finding one or two schools to trial the materials they have written. This will provide a reasonable but manageable sample. In some cases the authors will be involved in teaching the activities as well as the class teachers. A small research team from the Open University will take a more detailed look at the use of the trial materials in three schools.

References

- DFE (1995)
  Design and Technology in the National Curriculum
  London, HMSO 1995

CASE STUDY 13

Standards for Technology Education in the USA

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The First Step

The Technology for All Americans Project has spent the past two years in Phase I researching and developing a Rationale and Structure for the Study of Technology that will be the foundation for developing the standards for technology education. The project was funded by the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA) to the International Technology Education Association (ITEA).

This rationale and structure document discusses the power and the promise of technology and the need for universal technological literacy. Universals for the study of technology are presented. The document also describes how technology should be integrated into the core of the curriculum from kindergarten through high school and beyond. Finally, a challenge is made to all concerned to take action to establish technology education standards and make technological literacy a national priority.

The Power and the Promise of Technology

Technology is a fundamental aspect of human activity. The acceleration of technological change is a constant in everyone's life today. The power and the promise of technology is based on the need for technological literacy – the ability to use, manage, and understand technology. Technological literacy is considered to be critical to the success of individuals, entire societies, and to the Earth's ecological balance.

A Structure for the Study of Technology

Agreement on the need for technological literacy is just the beginning. The more difficult problem is determining how to develop this literacy. What experiences, abilities, and knowledge are needed? What exactly should a person know about and be able to do with technology? What should be the content of this literacy effort? The specific answers change with a person's location, as well as individual aspirations, career, and capabilities.

The structure developed for the study of technology focuses on universals of technology that are considered to be significant and timeless, even in an era dominated by uncertainties and accelerated change. As the definition indicates, there is a knowledge and process base for technology that is quantifiable and universal. The technological knowledge includes the nature and evolution of technology, contextual relationships or linkages with other subject areas, and technological concepts and principles (Figure One).

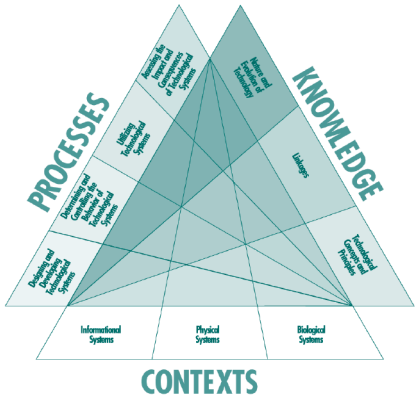

Figure One – The Universal Triangle

The processes are those actions people undertake to create, invent, design, transform, produce, make, control, maintain, and use systems. The processes include the human activities of designing and developing technological systems; determining and controlling the behaviour of technological systems; utilising technological systems; and assessing the impacts and consequences of technological systems. Both the knowledge and processes are critical to the existence and advancement of technology. One cannot exist without the other, for they are mutually dependent. With technological knowledge people engage in the processes, yet it is through the processes that technological knowledge is developed.

People develop technological knowledge and processes in order to create and use systems that solve problems and extend their capabilities. Invariably this involves physical, biological, or informational systems to manipulate the natural world. In other words, people develop technological processes and knowledge within the context of adaptive systems, which are the means that people use to modify nature.

Knowledge, processes, and contextual systems, then, have been identified in this document as the universals of technology, and are considered the foundation of the structure for the study of technology. Each of the universals is discussed in detail within the document.

Teaching Technology

School systems across the country must establish effective technological literacy efforts, beginning in kindergarten and continuing each year through high school. By using the structure outlined in the document, communities can incorporate the necessary concepts and experiences so all students have the opportunity to develop the necessary knowledge and abilities. By incorporating the universals of technology throughout the curriculum and in technology courses, schools can provide experiences that instill insight and problem-solving capabilities.

Technology should be a required subject for every student at every level. This vision necessitates curriculum development, teacher enhancement, and in some cases, restructuring building space. However, it is an effort that will reap rewards for every community in the country. The study of technology during the elementary school years, middle school years, high school years, and beyond should become a national priority.

Taking Action

To help achieve technological literacy at a national level, standards for technology education should be developed based on the universals and structure described in the Technology for All Americans – A Rationale and Structure for the Study of Technology document.

The International Technology Education Association and the Technology for All Americans Project provide the support, knowledge-base, and opportunity for groups, agencies, and associations to become involved in the promotion of technology education as an essential core subject in our nation's schools.

Developing Standards

The Technology for All Americans Project plans to develop technology content standards for grades K-12 in Phase II. The time frame for accomplishing this is three years (from October, 1996 to September, 1999). There will be assessment checkpoints or benchmarks at grades 2, 5, 8, and 12.

Types of Standards

The term 'standard' has many meanings. In reviewing the National Council of Teachers of Mathematics (NCTM) Curriculum and Evaluation Standards for School Mathematics (NCTM, 1989), it defines a standard as a 'statement that can be used to judge the quality of a mathematical curriculum or methods of evaluation'.

The National Research Council (NRC) in the National Science Education Standards (NRC, 1996) states that 'science education standards are criteria by which to judge quality of what students know and are able to do, of the science programs that provide the opportunity for students to learn science, of science teaching, of the system that supports science teachers and programs, and of assessment practices and policies'. The Technology for All Americans Project defines standards as 'descriptive statements established by key professionals that can be used as criteria for assessing the degree to which technology content, teacher enhancement and teacher preparation, student progress, and programs meet qualitative and quantitative characteristics of excellence'.

Two groups will advise and provide input to the Technology for All Americans Project during the development of the K-12 content standards – the Advisory Group and the Standards Team. An explanation of the responsibilities of each group is as follows:

The Advisory Group

The Advisory Group will advise the best practice in standards development and to determine ways for the study of technology to be integrated within the total school curriculum. Representatives of the National Council for Teachers of Mathematics, the National Science Teachers Association, the American Association for the Advancement of Science Project 2061, the National Research Council, and the National Academy of Engineering will form an Advisory Group for the Technology for All Americans Project. They will meet semi-annually to provide specific advice on the development of the standards and how technology education can be integrated within other school subjects, especially science and mathematics. In addition, consultants will be brought in to provide advice to the staff on the development of the standards. These may include specific personnel who were closely involved in the development of the math standards, science standards, geography standards, and other standards.

The project will develop close alliances with the National Council for Teachers of Mathematics, the National Research Council, the National Science Teachers Association, the National Geographic Society, the American Association for the Advancement of Science, the National Academy of Engineering, and other associations representing school subject areas. Additionally, the project will create alliances with engineering and other technology career-related fields in the development of the standards.

The Standards Team

The Standards Team will propose, evaluate, and recommend the content of the standards. In the review and consensus-building process, representatives not only from technology education, but from mathematics, science, engineering, and other school subjects will contribute to the improvement of the standards for technology education as they are developed and modified. The Technology for All Americans Project plans to use a Standards Team comprised of three sub-teams (one team for grades K-2 and 3-5, one team for 6-8, and one team for 9-12) to provide input for the development of standards. The team will be made up of classroom teachers, supervisors, and teacher educators from technology education, as well as elementary administrators and representatives from math, science, and engineering. The leaders of the three sub-teams will be involved in providing input to the Technology for All Americans Project staff who will be responsible for the writing, generating, and consensus-building process for the standards. The first meeting of the Standards Team was held on October 25-28, 1996 at the Xerox Document

University in Leesburg, Virginia. At this meeting, the universals were utilised to generate the organisational or broadest level of the standards by benchmark grade level. After this was done, the teams worked on developing first drafts of the more specific or detailed standards, which are concerned with what each student needs to know and be able to do in order to be technologically literate. In some cases, the teams went one step further and developed the most specific level in the architectural hierarchy of the standards.

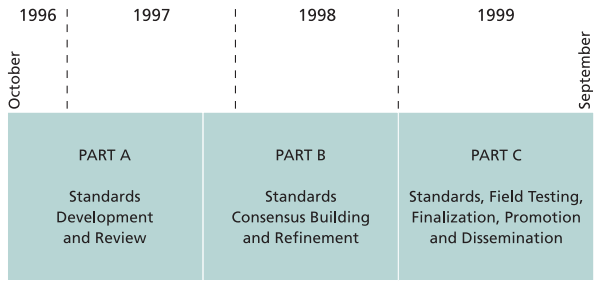

Figure Two – Timeline for Phase II

A broad timeline for the three years of Phase II is shown in Figure Two. During the first year of the project (Part A), the focus of the project work will be on developing the hierarchical structure of the standards and then adding content to that structure from grades K-12. During this time, the project staff will work closely with the Standards Team in generating the standards around the universals that were developed in Phase I of the project. The Standards Team leaders will met in March, 1997 to review the standards. In the summer of 1997, the Standards Team will meet again to review and refine the standards. During the time from fall, 1997 to the end of 1998 (Part B), the standards will go through a consensus building and further refinement process. Hundreds of people from the technology education profession as well as from other fields such as science, mathematics, engineering, etc. will review the document by mail or by electronic document review. Consensus hearings for additional reviews will be held at national, regional, and state conferences. In the final part of Phase II of the project (Part C), the standards will be field tested in selected schools in the United States. From all of the input received in many developmental drafts and field testing, the standards will go through a final editing and will be published in the summer of 1999 (in time to be implemented for the 1999-2000 school year). During this time, the project plans to develop extensive promotion and dissemination activities on the standards in 1998-1999 so that technology education professionals, as well as educators in general, will know what the Technology Education Standards are and how they can assist in improving technological literacy for all children.

The Project Staff

The staff will coordinate the total project and work with the Advisory Group, the Standards Team, and the profession in developing, consensus building, and validating the standards. The staff will have the responsibility of research as related to the standards. The staff will work with the ITEA, NSF, and NASA in the overall operation of the project including working with third party evaluators Phi Delta Kappa. Another task of the staff is to assure that the standards for technology education are compatible with other educational standards that are being developed or already exist, especially those in science, mathematics, social studies, and the humanities.

Standards and Curriculum

It is not the intent of the Technology for All Americans Project to develop curriculum. The standards for technology education will provide a general framework from which states and local school systems can develop technology curriculum that is best suited for their students. The ultimate goal of both quality standards and a well-designed and implemented curriculum should be technological literacy for all students (Figure Three).

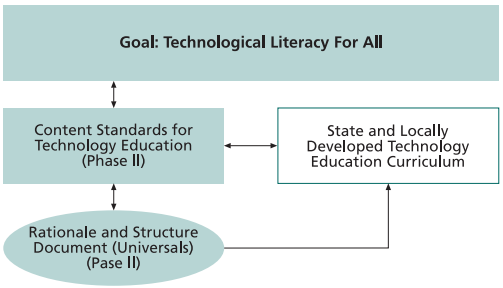

Figure Three – Relationship of Technology for all Americans and state/locally developed Technology Education Curriculum

In Figure Three, content standards specify what students should know and be able to do in technology. They indicate the knowledge and skills – the ways of thinking, working, communicating, reasoning, and investigating, and the most important and enduring idea, concepts, issues, dilemmas, and knowledge essential to technology – that should be taught and learned in school. They are derived from the Universals of Technology. Curriculum is an operational plan for instruction or the way content is delivered: it includes the structure, organisation, balance, and presentation of the content in the classroom. It is the responsibility of the state or locality to develop the curriculum. Again, the standards for technology education will not develop the curriculum.

It is very important that standards be set high enough to ensure that all students can participate fully in society. Special considerations must be made in the standards to assure that all learners benefit from technology education. Technology educators must hold high expectations for each student and every school. Standards, by themselves, cannot erase the results of poverty, or ethnic and cultural discrimination. It is essential that all students have equal opportunities to study technology and that inequalities

in school resources be addressed. It is also important that safe and supportive environments be provided for the teaching of technology and that schools have an adequate supply of knowledgeable teachers who are motivated and qualified to provide exceptional learning experiences.

Future Steps

It is the long term plan of the International Technology Education Association and the Technology for All Americans Project to develop complementary standards to the K-12 content standards that will address student assessment, teacher enhancement and teacher preparation, and program assessment at the individual school and/or school system level. A systemic structure of all of these various types of standards and the audiences that are affected is shown in Figure Four.

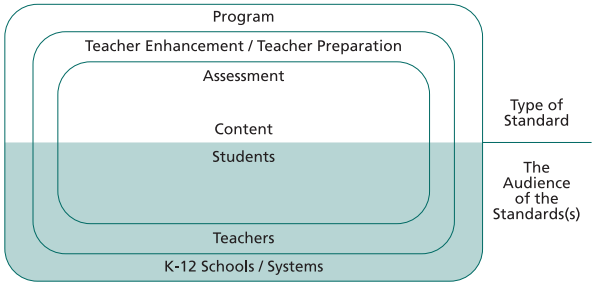

Figure Four – Systemic Structure of Types of Technology Standards and the Audience of the standards (adapted from Pratt, the National Science Teacher, October 1995, p.24).

Note: that the content standards in technology education relate directly to the student as the audience. They reflect what every student should know and be able to do in technology. More specifically, they indicate the knowledge and skills – the ways of knowing and doing. Curriculum content standards should directly reflect the most important and enduring of the universals of technology. Assessment standards, which are sometimes referred to as performance standards, will specify the degree to which content standards have been attained in the performance of the student. The National Education Standards and Improvement Council (NESIC) states that performance standards indicate both the nature of the evidence (such as a project, portfolio, research paper, completed design brief, etc.) required to demonstrate that the content standard has been met and the quality of the student performance that will be deemed acceptable (NESIC, 1993, iii.). Diane Ravitch in her recent book National Standards in American Education stresses the need for both content standards and performance (assessment) standards by saying that 'content standards without performance standards are meaningless. Content standards define what is to be taught and learned; performance standards describe how well it has been learned' (Ravitch, 1995, pp.13). The Technology for All Americans Project proposes that the assessment standards for technology education will be developed later in the project after the content standards are created and validated.

Finally, the Technology for All Americans Project will develop program standards for technology education. Adequate resources, such as facilities, equipment, and supplies/materials are central to a quality technology education program. Program standards will provide a framework for assuring quality district level or school level programs in technology education. This framework will provide criteria on all elements of the K-12 technology education program that are consistent with each other and which are articulated within and across each grade level. The technology education program should be coordinated with other school subjects to promote inter-disciplinary learning. The Technology for All Americans Project will utilise the Standards for Technology Education Programs (1986) as a key resource in developing new program standards.

In addition to developing content standards, assessment standards, and program standards, the project proposes to create teacher enhancement and teacher preparation standards. The teacher enhancement standards will present the criteria for inservicing the existing elementary and technology teachers in the classroom/laboratory. Standards will be developed that will provide criteria to be used in making judgments about the quality of professional development opportunities (pre-service for new teachers of technology education). This is very important since many states are already experiencing a shortage of qualified and certificated technology education teachers.

In Conclusion

This paper has presented the background of the International Technology Education Association's Technology for All Americans Project. It has presented the accomplishments in Phase I with the creation of a Rationale and Structure for the Study of Technology. In addition, an overview was presented on the plan for Phase II of the project to develop the standards for technology education in grades K-12. Also, the generation of future standards for student assessment, program review, teacher enhancement, and teacher preparation was discussed.

The ultimate vision of the Technology for All Americans Project is to present a foundation for what every student should know and be able to do with technology to be technologically literate. All of us have a stake, as individuals and as a society, in technological literacy. Without technological literacy, we have the potential of a chaotic future. With technological literacy, people can use technological knowledge and processes to make sound personal decisions and to participate in discussions of technological issues that affect society and the environment. The real hope and promise of the future lies not in technology alone, but in the people's ability to use, manage, and understand it.

References

- National Council of Teachers of Mathematics (1989)
  Curriculum and evaluation standards for school mathematics
  Reston, Virginia, Author
- National Council for Teachers of Mathematics (1991)
  Professional standards for teaching mathematics
  Reston, Virginia, Author
- National Education Standards and Improvement Council (1993)
  Promises to keep – Creating high standards for American students
  Washington DC, National Goals Panel
- National Research Council (1996)
  National science education standards
  Washington DC, National Academy Press
- Pratt H (1995, October)
  The national science teacher, p.24
- Ravitch D (1995)
  National standards in american education
  Washington DC, The Brookings Institution, p.13
- Technology for All Americans (1996)
  Technology for all americans – A rationale and structure for the study of technology
  Reston, Virginia
  International Technology Education Association

NOTES

CONTACTS

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The Design and Technology Association

Background

The Design and Technology Association (DATA) is the recognised professional association which represents all those involved in design and technology education. DATA is committed to securing, developing and enhancing design and technology in all sectors of education and society and aims to achieve this by:

- *developing a high quality curriculum concerned with designing and making skills and attitudes which are appropriate to the twenty-first century*
- *enhancing the quality of teaching and learning in design and technology*
- *developing positive links with other curriculum areas, especially science, mathematics and art and design*
- *working with industry and commerce to ensure the benefits of such experiences permeate the curriculum at all levels*
- *influencing society around us and bringing increased recognition of those involved in designing and making.*

DATA in action

One of DATA's key roles is to keep its members informed. This is achieved by publications (a termly journal newsletter, and specialist materials), regional conferences and a national conference held each year. DATA also provides a telephone support service, and regularly exhibits at all the major exhibitions and events in the educational calendar. DATA contributes to research activities in design and technology and works closely with a wide range of projects to develop curriculum materials and guidance for members. DATA works with other countries in widening our understanding and promoting the international development of design and technology.

Links to support design and technology

DATA works with all the key organisations involved in design and technology education:

- Government departments and agencies such as OFSTED, SCAA, NCVQ and TTA
- Local Education Authorities, The Engineering Council, The Design Council, SCSST, NCET, TECs and other bodies
- Initial teacher education establishments and In-service education providers
- Other professional associations
- Curriculum development projects
- Industry and commerce – DATA has the support of a number of major companies
- Suppliers of resources for teaching – many are associate members of DATA.

What DATA's members receive

To support its members, DATA provides the following:

- A termly Journal and Newsletter
- A growing list of specialist publications at discount prices
- A free copy of DATA's Directory of Consultants
- An annual conference and AGM
- Special-event conferences to address topical issues
- Professional liability insurance for individual members
- Access to the resources and library at Wellesbourne House.

Further Information

Any further information relating to this conference, or courses, research opportunities and In-service work provided by CRIPT can be obtained from:

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