# Primary School Technology: Where is it Going?

Anne Smits
*Booth Wood Primary School, Loughborough*

## Introduction

The intention of this article is to share some thoughts and experiences of primary school technology so that teachers may analyse their own ideas and practice. It is not to provide answers, for I believe those answers, ultimately, must come from primary teachers themselves when they have thought more deeply and had more experience of technology and related activities.

The encouragement of the development of technology in the primary school has led to confusion about what is expected and a feeling of inadequacy in many a conscientious teacher, who is, more often than not, female with a limited backgound in CDT or science. This has come about, I believe, because the term technology is linked to secondary school subjects (CDT) usually taught by a male teacher, specifically trained for the job, employing specialist knowledge, skills, tools and materials.

However, encouraged by the view of Tope (in *We can do it now,* an Equal Opportuities Commission publication[1]) that the main criterion for a teacher undertaking primary school technology 'is not his or her sex, but the enthusiasm for the subject, and enterprise in developing ideas which can lead to the use of technology', I set about introducing CDT into the school curriculum.

I attended a course made up of a series of meetings to discover the purpose and ethos behind primary technology and to learn a simple construction technique for use with young children. Subsequently, I organised an in-service workshop for teachers from local schools to which the teachers brought two pupils each and teachers and children worked side-by-side at acquiring the necessary skills to carry out constructions — in this case a simple chassis — which were tested and evaluated at the end of the day-long session.

The constructions were based on a technique pioneered by Jinks[2] and consisted of employing wood strip, dowel, card and adhesive for building structures to which a variety of materials and parts can be added to make models. The general philosophy behind this technique is that young children should be able to make accurate strong models safely, using simple, readily available tools and materials in the primary school classroom. Once the technique has been learnt it is hoped that it will be adapted by teachers and children according to the current topic, project or field of interest, whenever possible.

First Published in *Education 3-13* March 1988


## A survey of primary school technology

In the Summer term of 1986 I carried out a survey of primary schools in order to obtain information about the use to which the above construction technique was being put, teachers' attitudes to primary technology and their perceptions of future needs. An attempt was also made to define and identify the practice of primary technology. An 'opportunity' sample of 12 schools catering for the nursery/infant/junior age range was chosen from those schools who had put forward teachers to attend the above in-service course and other schools in which I had personal contacts. One might assume that such sample would have a bias towards technology in the curriculum; on the other hand schools' participation in such courses might just as well indicate an interest in curriculum development in general.

Semi-structured, informal interviews were used, based on a questionnaire designed to elicit general information about the organisation of the curriculum of the school, values and attitudes towards primary school technology, availability and use of resources and current practice. In many cases I was able to speak to children in their classrooms also. In order to supplement the evidence collected in interviews, I also used informal observation. As in the case of the questionnaire, notes were made at the time and immediately after the visit, mainly about:

(a) displays and resources;
(b) the way in which teaching areas were used;
(c) the amount of pupil-initiated work;
(d) the opportunity available for the children to display individuality in their work.

I chose these aspects since I felt they would reflect the school ethos, the degree to which pupils are encouraged to speculate, evaluate and think for themselves and attitudes of the teachers towards these activities and technology.

## Defining primary school technology

In order to identify the practice of technology in the primary school, I had to arrive at a definition of what I was seeking.

DES documents[3], reports from the Engineering Council and Standing Conference of Schools' Science and Technology[4] and Schools Council documents[5] all emphasise the extent of the interested bodies and the wide application of the term technology when applied to the primary school curriculum.

In 1980, when searching for a definition of CDT, HMIs highlighted the general acceptance of the fact that

> 'boys and . . . girls in school should discover the physical and aesthetic qualities of materials, acquire the skills to shape them and perhaps, above all, learn to plan and to execute work of their design'.[3]

Two years later the East Anglian Examination Board was quoted as defining technology thus:

> 'the identification of the needs of man and the endeavour to satisfy those needs by the application of science and use of materials, resources and energy. It is concerned with solving problems where there is no right or wrong answer . . . Technological behaviour requires activities that are creative and demanding . . . involves approaches and techniques . . . that are more than pure science or craft'.

Added to this was the view of CDT teachers that technology in school should include an active involvement on the part of pupils in making and designing artefacts or systems.[3]

*Problem Solving: Science and Technology in Primary Schools*[4] recognised five areas in the curriculum which contained activities that offer some links to the man-made world — primary science, primary craft, design and technology, mathematics, problem solving and the new technologies.

In the same year, 'designing and making' became the main title of an exhibition of CDT work from children

of all ages and was adopted as a term more suited to primary school work 'which has as its particular focus the man-made world of objects and devices', and in which three levels of activity can be identified. 'The first level is that in which there is no three-dimensional construction and the child's designing is shown by drawing and writing . . . At this level the range of activities is confined to:
thinking,
speculative designing,
evaluating.

. . . The second level is that in which the results are shown by model making using soft materials, scrap materials and constructional kits. At this level a restricted range of activities occurs:
thinking,
speculative or practical designing,
constructing malleable or kit materials to make models of real objects,
evaluating.

. . . The third level is that in which the results are shown by an object or device that actually functions in some intended way made in any appropriate material, and capable of being evaluated in real terms. At this level a full range of activities occurs:
thinking,
practical designing,
constructing resistant materials to make a real object or device,
evaluating.' (quoted from Brough)[6]

In looking for instances of practice of primary school technology, the recognition of the three levels of activity above in conjunction with the five curriculum areas offering links to the man-made world was taken as a guide to evidence of such practice, and will suffice for this discussion although the combination of designing and making has wider implications for cross-curricular activity.

Due to the often brief and limited observations of ongoing and displayed work, usually gathered during a single visit to any one school, this section of the report will be confined to an overall view of activities in the schools surveyed in (1) the nursery/infant age range and (2) the junior age range.

1. *The nursery/infant age range*
Three different recurring science themes observed in the schools were 'sound', 'electricity' and 'magnetism'. Simple concepts concerning electricity and magnetism were shown to the children and they incorporated them into simple toys and games, using mostly scrap materials. Similarly, children were helped to make a variety of instruments to be plucked, hit or shaken. No formal designing or planning often decorated their instruments individually and talked to each other and their teachers about the activities.

In a topic on 'water' children were encouraged to design boats before making 'junk models' — few floated for long due mainly to unsuitable materials, gaps in construction, but the teacher seized on these opportunities to explore the propreties of different materials, concepts of floating and sinking, weight and balance.

Within a topic about 'wind' infants made windmills; others made carts from boxes during an exploration of 'shape' — in both cases thinking and evaluating took place within the activity of making. 'Mirrors' was another starting point for model making in the infant classroom and the children made kaleidoscopes.

In one school the children had been introduced to levers, gears and pulleys through experience of lifting, pulling and turning. The teacher had made visual aids from cotton reels, card circles and had displayed cogs; a pulley was suspended from the classroom ceiling; children experimented with levers — a staple remover, a claw hammer, a *see-saw*, and they looked at mechanisms of clockwork toys. A visit to a local engineering workshop in which levers, cogs and pulleys were seen in action was another aspect of the topic. The children drew pictures and wrote about their experiences and observations. No designing or model making was noted but this was an ongoing topic and could well introduce these aspects at a later date.

'Bridges' was a topic in another infant classroom in which the teacher had consciously introduced all the aspects of designing and making. After a television programme, children had experimented with structures and spans and had been introduced, in a very simple way, to different sorts of bridges; they had made drawings of their favourite kind of bridge and had constructed models and tested them. There were fantastic models as well as 'sensible' ones and in true infant fashion the children were usually able to justify and explain the discrepancies between drawing and model.

One teacher arrived at the topic of 'bridges' by another route. The children started off by looking at plane shapes; they identified them in the environment and make them up out of kits, discarded materials, plasticine, etc. Through trial and error they discovered that the triangle provided strength to a construction and they built bridges and other structures.

In all thesee activites it was mainly through spoken language that the thinking, speculative designing and evaluating was carried out. Model making was often the start of the exercise or a way of applying simple scientific concepts. It is worth noting that most infant teachers had not considered that they were introducing technology to the children.

2. *The junior age range*
'Magentism', 'electricity' and 'sound' were science topics which also occurred at least once in the junior school classes of the survey. Again, the principles learnt were incorporated into games, toys and instruments. Evidence of thinking, designing (guided and limited), constructing real objects (easier when applied to toys) and evaluating was noted.

In the case of the 'sound' topic, evaluation was carried out not only according to consideration of function (can you get a noise from it?) but also according to aesthetic considerations (does it sound pleasant? Is the shape and decoration attractive?).

'Bridges' were a centre of interest again, with television providing the initial stimulus, but the teacher concerned shelved the project until she could approach it better prepared, since she realised that the children's background knowledge was inadequate for what they were trying to do in their model making. The same teacher had also done work on the construction and testing of model 'cable cars'. The children had made a variety of models, without much prior thought, which they tested and evaluated as a group. They subsequently chose two of the ideas on which to base their final designs and set

about drawing and making plans and models. Much work evolved around the exploration of angles, friction, and pulleys and the children recorded their ideas and evaluations through writing and drawing.

Within the aspect of primary craftwork came the making of 'puppets' stimulated by a language exercise which required the children to follow written instructions to construct their models. Each child went on to design individual dress and features for their puppets and they were planning to write a play and design a stage set.

Another junior class had had a brief introduction to the concept of 'shock absorption' and had touched on the relationship between weight, speed, force, impact, compression and had explored ways of presenting paper to absorb impact and minimise damage. The exercise involved the examination and evaluation of principles for future use rather than designing of an object to which to apply them. Discussion and written and drawn records encouraged thinking.

By far the most popular model making undertaken in eight classes within four schools was that of a basic 'chassis' which, in seven out of the eight classes, was based on Jinks' construction technique. In most cases, one of the main aims had been to introduce children to the simple technique and to the use of suitable tools. From this beginning many children went on to modify their chassis and to design and make superstructures after they had tested their models for smooth, straight running and had modified them accordingly. Some of the children were set tasks such as finding ways of getting the 'vehicles' to travel uphill or to stop at a given distance. One group of children decided they wanted their models to turn in a circle; they observed and discussed a Lego model produced by a member of the class and enlisted the help of an adult to modify original designs. Basic chassis work was quite prescriptive but many children put a lot of individual thought and work into finishing touches and shared their ideas.

A top junior class converted their basic chassis into 'war machines' in an exploration of propulsion and trajectories and adapted the technique to make structures other than chassis. The children illustrated written accounts of their work and evaluated and modified their models.

In yet another school the teacher in charge of science started a topic by looking at ways of moving objects leading to the topic of 'wheels' which in turn led to the making of wheels of all sizes from a variety of card, wood and scrap materials and applying them to model vehicles. Concepts similar to those explored by the children above were introduced, drawing generally being carried out after the model making.

**The five curriculum areas linked to primary school technology**

In both infant and junior classrooms the activities observed contained evidence of primary science, craft, maths and problem solving — the new technologies area of the curriculum was not apparent.

Within the survey it was difficult to find an activity which involved all these areas. Typically, science predominated, yet in the infant school craft, design, technology and problem solving occurred during the development of manipulative skills, through insights gained into properties of materials, the improvisations and modifications made to drawings and models after simple tests and evaluations, the assembling a components from a kit, the acquisition of simple technological language such as 'axle', 'bolts', 'pulley', 'power', etc. Maths was going on in the children's counting, ordering, matching, measuring, comparing, exploring of two and three dimensional shapes, open and closed spaced — all part of their drawings and/or model making.

The making, testing amd modifying of vehicles in some junior classes also branched out from craft work into problem solving and science, and embracing some maths and elements of art.

**The three levels of designing and making**

The first level frequently occurred within the younger age range of the school and the second level often overlapped the first. In the infant classroom, the distinctions between thinking, designing, evaluating and model making were blurred. The child would talk about the picture he had drawn of his pedal-car, explaining how he thought it worked, justifying the inclusion of that wheel or this light, perhaps modifying his picture as new ideas or discrepancies occurred to him through his communication with a peer or the teacher. Children were observed talking to themselves as they put their ideas down on paper, correcting themselves verbally and through their drawings. The child also used his model making in the same way — whether made from discarded materials or commercially produced kits such as Lego, Bigbuilder, Educastor, etc. Occasionally, children would draw and make models.

The first two levels are obviously an important preparation for the third and it is feasible to assume that those children who had gone through the stages of speculative designing and model making would be ready to design in a practical way and possibly make a real object or device; however, not many of the older children were thinking and designing before making models and evaluating was not always carried out; few children experienced success at the thrid level. The synthesising effect of design, observed in infant activities and which David Jinks and Pat Williams[2] consider to be one of its most valuable contributions to the curriculum, was lost.

**Is it primary school technology?**

In considering whether the activities observed in the schools can be termed primary school technology it is useful to refer to some of the definitions *referred* to earlier in this article:

> Children 'should, above all, *learn to plan and to execute work of their own design'.*
> *'Technological behaviour requires activities that are creative* and *demanding'* and 'involves approaches and techniques that are *more than pure science or craft'.* (DES)[6]

From the survey it would appear that the elements of individual designing and planning and the intellectually demanding and creative aspects of the children's work are the weakest points of their technological activities — the bulk

of the work being reliant on the science and craft areas of the curriculum.

**Confusion and inadequacy**

In these circumstances it is surprising, therefore, to record some of the respondents' views of the special contribution that primary school technology has to make to the curriculum:— the importance of the cognitive aspects of thinking, planning and evaluating was mentioned as well as the way in which understanding is promoted through the recognition of relevance rather than the mere acceptance of facts; the development of personal qualities such as perseverance and self-sufficiency and the synthesising effect of design-related activities right across the curriculum were also introduced as positive benefits to be gained from primary school technology.

So why are these aspects under-represented in the primary school classroom? One reason may be the confusion that surrounds the definition of primary school technology; some respondents identified it as 'up-to-date craft work', the 'physics of science', 'applied science', 'it must have wheels — it's to do with things that move', 'it's making models' . . . 'problem solving' . . . 'acquainting children with industry'.

Another contributory factor is the fact that all but one of the teachers interviewed were women, most of whom were ready to believe that they were 'not very good at technology' yet were delighted to discover that they could, in fact, use tools and design and make things when they attended courses.

Flood[7], adviser to the DES film 'Technology Starts Here' and Central Television's 'Starting Science', believes that in primary school technology a 'controlled, prescriptive phase is necessary to ensure that children get some initial success and begin to characterise themselves a 'good at this'. He goes on to say that the justification of this phase is when 'it leads to a second phase where both [teacher] and pupils have a rich opportunity to explore further problems and possibilities on a more individual basis'.

Just as children need guidance in thinking, designing, making and evaluating, so do many teachers need to have a 'prescriptive phase' to launch them successfully into a way of teaching that may be new to them.

**Science schemes and primary school technology**

Another set of responses worth examining in more detail is that concerned with the curriculum areas thought to be most closely involved with primary school technology.

Half the interviews were conducted with the teacher interested in science, two with the art and design specialists and the remainder with a head teacher or teacher with no main interest.

One can assume that many of the responses to the questionnaire and activities selected for observation would be based on the viewpoint of a person particularly interested in science. Science was put forward as having the strongest link with technology (9/10 schools) and craft was mentioned as being important from the model making and decorative aspect (8/10 schools). From the summary of activities observed in the primary school it can be seen that science topics provide most of the stimuli.

With this in mind, four primary science schemes were briefly examined for technological content employing the criteria discussed in the definition used for this survey:

> *Science 5-13.* (Schools Council), 1973 MacDonald Educational.[3]
> *Learning through Science.* MacDonald Educational.[3]
> *Science Horizons.* (West Sussex 5-14 Scheme).[8]
> *Exploring Science and Technology.* 1986, C.U.P.[9]

In all these schemes the elements of speculative and practical designing and the construction of models and real objects or devices was very limited. Despite a good deal of background materials which could provide a basis for designing and making', the designs were given and instead of evaluation and modification the children were asked to observe and record.

Many questions asked of the children on workcards suggested a closed 'yes' or 'no' answer; eg 'Can you . . . ?' not 'How can you . . . ?' The most recently published scheme, 'Exploring', has a 'more to explore' card for each of its 12 modules which introduce more technological content — some design is mentioned (ie drawing and planning) but not emphasised. The authors, despite the title of the scheme, have not paid much attention to children's needs to 'learn to plan and execute work of their own design', or the importance of encouraging 'activities that are creative and demanding' and 'approaches and techniques that are more than science or craft'.

**The importance of drawing within the design activity**

Children's growing awareness of the elements of art (line, pattern, shape, colour, texture, etc), the use children make of their drawings, particularly the younger ones, in clarifying and expanding their ideas and the emphasis placed on planning and designing by L. Brough (1985) reflect the concern of HMI that 'boys . . . and girls in school should discover the physical and aesthetic qualities of materials'. DES (1980). Unfortunately, the survey demonstrated that many children were less inclined to use drawing as they progressed through the primary school.

John Steers[10], General Secretary of the National Society for Education in Art and Design, regrets the exclusion of the word 'art' from design policy documents.

> 'Teaching "awareness" of design and its process is not enough. One of the essential areas they (teachers) must teach is intelligent observation and analytical freehand drawing . . . Drawings are often a surer guide to a designer's thinking, and the quality of that thinking, than verbal analysis'.

It is interesting to note here the comments received from four CDT departments in secondary schools that receive most of the children from the schools involved in the survey. Although their organisations are programmes of work differed a great deal, all stated that they would like children to have done more drawing in their primary schools — both from observation and as a means of planning and designing work.

Also, it was thought that most children, at the age of 11, still tended to regard a piece of work as 'a one-off' and they were not accustomed to

perservering with their work, to evaluating it and modifying it.

**In conclusion**
Several areas in the primary school curriculum were identified in which work of a technological nature was being done, the area of science predominating; but the important aspect of evaluation was not being fully exploited and the weakest elements were those of planning and designing.

The strong bias towards science appears to be at the neglect of other areas. However, this relationship with science may be necessary if technology is going to be taken seriously in the primary school, because science is beginning to acquire the status of a 'basic' in the curriculum, along with mathematics and language. This implies that the subject is indispensable to a child's education and is self-perpetuating since schemes of work, methods of evaluating and recording, etc, appear in the schools, in-service courses are set up, all of which are seen as a justification for developing the subject and giving it more curriculum time. It also helps to reduce the confusion and feelings of inadequacy which were made so apparent through this survey.

However, in the long-term, this alliance with science may distort primary school technology since its application may be restricted to scientific knowledge and procedures and prevent the child from using common sense, everyday knowledge, gained from a *variety* of experiences, in the solution of problems.

In conjunction with designing, technology has an important part to play in providing a link between the cognitive and practical aspects of learning, in pulling together the threads of the curriculum and introducing relevance into children's schooling. For this reason alone it should not be seen to be tied too strongly to any one curriculum area.

Finally, I return to the purpose of this article, which is to encourage those in primary education to think more deeply about their practice, for, as in all areas of the curriculum the success or failure of any initiative and the quality of the child's learning experience rests on the understanding, commitment and expertise of the teacher.

**References**

1. Everly, B. (1982) *We Can Do It Now!* EOC.
2. Jinks, D., Williams, P. (1985) *Design Technology 5-12.* Falmer Press.
3. DES (1980) *Craft, Design and Technology in Schools: Some Successful Examples.* HMSO, and; DES (1982) *Technology in Schools: Developments in Craft, Design and Technology Departments. HMSO.*
4. *The Engineering Council, SCSST. (1985) Problem Solving: Science and Technology in Primary Schools.*
5. *Schools Council (1973) 5-13 Project Nuffield Junior Science.* MacDonald Educational, and; Schools Council (1984) *Learning Through Science.* MacDonald Educational.
6. Brough, L. (1985) *Designing and Making: Learning Through Craft, Design and Technology.* East Midlands and Yorks Forum of Advisers in CDT.
7. Flood, J. (1983) *'Making Working Models Work'. In Primary Contact.*
8. West Sussex. (1985) *Science 5-14 Science Horizons.* Macmillan Educational.
9. Cambridge University Press (1986) Exploring *Pimary Science and Technology.*
10. Steers, J. (1986) *'The HiJacking of Design'. Times Educational Supplement, 7.3.86.*


**1988 Schools Design Prize**
*'The Village with Three Corners' is a new game devised by Claudine Hillier (15), Claire Morten (14) and Verity Cooper (14), from Chapel-en-le-Frith Comprehensive School. The game is designed to help young children by stimulating reading skills, and is based on the reading scheme of the local infants school, 'One, Two, Three and Away'.*