D&T from 5 to 16 — a continuous experience?

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A forthcoming book, *Design and Technology Activities: Understanding Practice*, by Richard Kimbell, Kay Stables and Richard Green, uses the data from 80 case studies to explore in detail a range of issues relating to progression, differentiation and the development of capability across all four key stages. The relationships between these new findings and those of the APU D&T project (Kimbell *et al.*, 1991) are also explored. This article looks particularly at the characteristic differences between D&T activities in the four key stages.

Introduction to the project

In 1992 we received funding from the Economic and Social Research Council (ESRC)* to establish a project looking at the ways in which children approach D&T activities. The project was based at the Technology Education Research Unit (TERU) in Goldsmiths University of London and ran from 1992 until 1994. Its aim was to build on and further the understandings gained through the APU D&T project by developing detailed case studies of how pupils across the key stages worked on D&T projects. To develop the case studies we observed the pupils at work, recording the fine detail of what happened every five minutes for the length of their project. This was done in two ways: firstly by recording a descriptive, narrative account of events, and secondly by recording activity against pre-coded aspects such as the pupils' engagement in the task, interactions with the teacher, and the design intentions and actions of the pupils. In total 80 case studies were created, covering virtually all age groups from Y1 to Y11, with a concentration on Years 5-8. The projects ranged from at one end, Y1 children working intensively in blocks of time totalling four hours, to at the other, Y11 pupils working on GCSE projects taking upwards of 50 hours of class time.

While each case study in itself is very detailed, the total sample is small; the findings therefore have to be seen as characteristic rather than representative and are not generalisable. However, the use of a common observation framework across this range enabled us to collect data on progression and continuity in ways which have previously not been attempted and this has produced a range of rich and interesting insights.

Differing experiences across the four key stages

One feature highlighted by the analysis of the research data was that there is no overall, single form of design and technology task, and that at each key stage there appears to be a characteristically different way of working. This has important implications for the progressive development of capability, and in relation to this a considerable number of issues emerged. These are explored in detail elsewhere (Kimbell *et al.*, in press), but the following examples illustrate how the particular issues of autonomy, discussion and collaboration, and the teaching of skills and knowledge are handled differently, rather than progressively, across the four key stages.

KS1: Cultural technology — 'Technology is part of life and is all around us'

At KS1, D&T projects are typically drawn directly from topic work. In the topic on 'Explorers' the children were designing and making shelters for those ship-wrecked on a deserted island. In a topic on 'Homes' they were designing and making a home for a toy spider.

For reasons of management, the whole class rarely do D&T together. Typically only one or two small groups are doing D&T at one time. Work is usually individual or in pairs, but carried out in a small-group setting where there is a great deal of informal interaction. Work is sometimes linked to a whole-class project: designing and making puppets for a class assembly or designing and making all the different things needed to turn the 'role play' corner into a baker's shop.

The children spend a lot of time talking things through, sometimes with others and sometimes on their own in 'thinking aloud' mode. The ongoing discussion is a major means of planning their way through the task. There is usually only limited input or control from the teacher, although the teacher and pupils will often set the initial constraints together. This was the case in designing the home for the spider, where the children decided at the outset that the home must:

- keep the spider dry and warm
- be big enough for the spider to live in
- not blow away in the wind.

Having set initial constraints, the children used them to keep 'on task.' Additional purposes and ideas are often added as the outcome develops. For example, one child added a slide to keep the spider entertained, another added a fishbowl and pictures on the walls (see also Johnsey, 1995). It is common for the children to produce a 'plan' (a drawing of the proposed outcome) early on, often using it for reference. The driving force behind the activity is the making, with planning and evaluating happening throughout but in a short term, responsive way.

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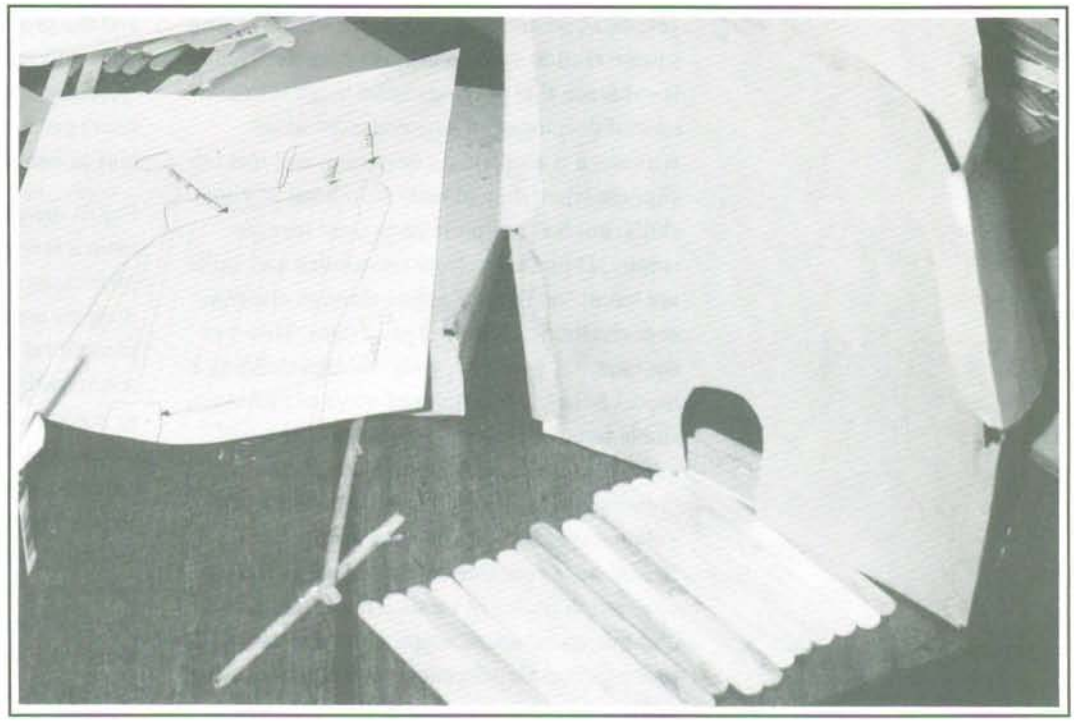


KS2: Problem-solving technology — 'Can you make it work?'

The pattern of work is similar to KS1, with small groups (individuals or twos and threes) working serially on projects, although in some instances whole classes are involved at once and sometimes this is with the technology coordinator in a special room. The projects are longer (the average length is about nine hours) but are usually carried out concentratedly in a few days.

Tasks are typically linked to topic work and therefore resourced by it — sometimes creating an indistinct line between where technology starts and finishes. This was the case where children were designing and making a museum exhibition where, in addition to D&T, they were drawing on their understanding of historical evidence to decide what to include, using maths to conduct surveys and using IT to analyse data and present their work. The history curriculum in particular has had a big impact on such topic work, generating activities such as the making of a working model of a English galleon, or designing shoes fit for Tudor royalty.

The children use a greater range of resources, including components for making things move. Structures tend to be made from scratch, rather than adapting 'found' materials (as often happens in KS1). This was the case with children designing and making 'powered

vehicles', where they created the chassis using square section wood and Jinks corners. There is evidence that previous knowledge is drawn on and developed in new contexts, as we witnessed with children designing and making slippers when they already held hand sewing skills, but had not previously used them to create 3D products. New knowledge and skills are learnt 'on the job', often through children experimenting from first principles. This was the case, for example, with children building a model house, who explored ways of making a stable structure in card before moving on to make the 'real' one in corriflute. Children creating the mast and rigging for the English galleon worked in a similar way, working 'hands on' to explore and gain understanding of creating pulley systems. This emphasis on children as autonomous problem solvers results in the further development of decision making skills.

KS3: Disciplinary technology — 'You need to know about this...'

The norm for projects at Key Stage 3 is that they are designed to teach specialist knowledge and skills. Typically there remain clear divisions between the separate disciplines in design and technology: resistant materials (CDT), food (Home Economics), textiles etc., and the projects are run in specialist facilities with different specialist teachers. The timetable typically allocates a block of time (roughly an hour) per week and projects typically last for half to one term.

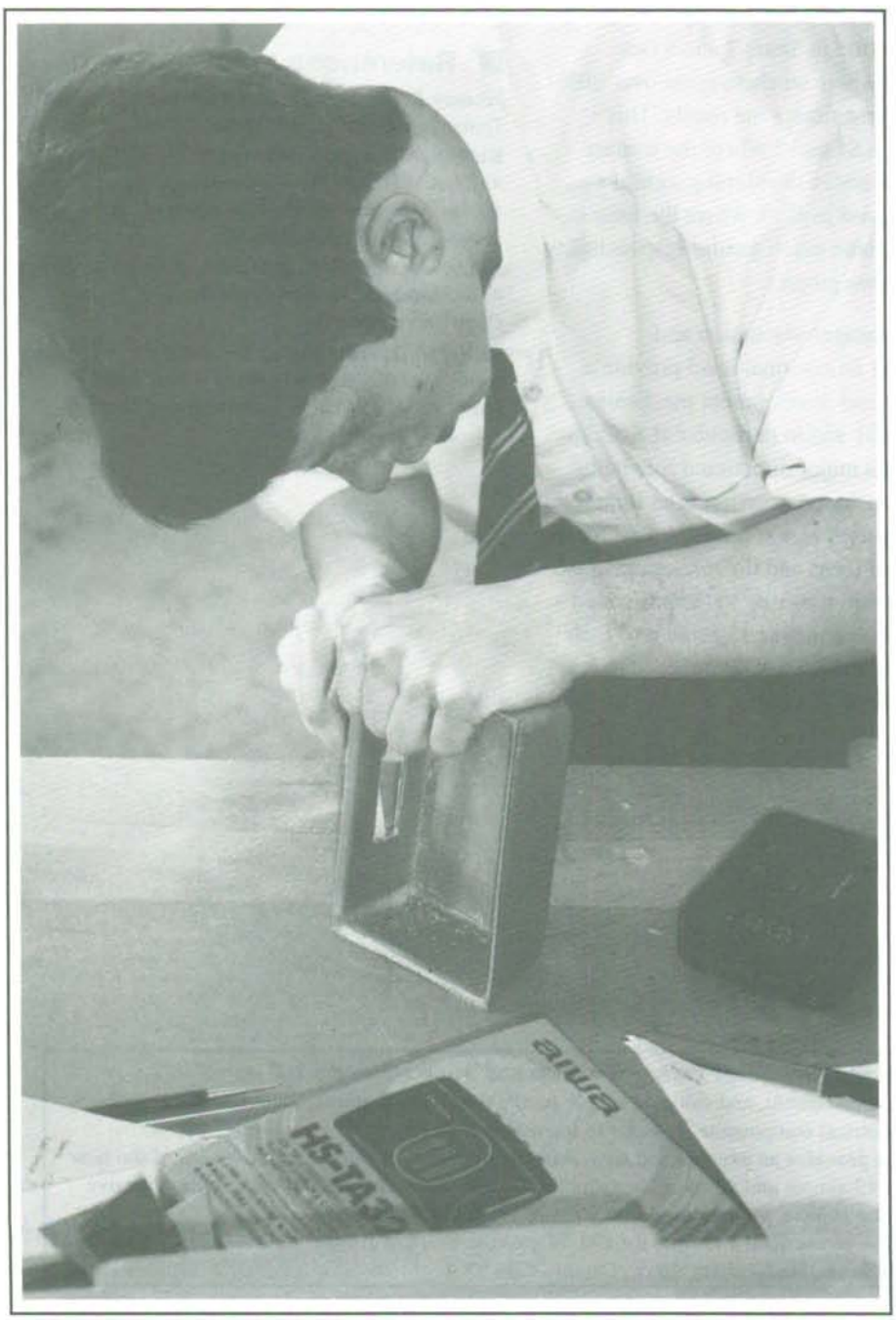
Pupils are often on a carousel system, rotating from a resistant materials project to a food project, to a textiles project and so on. The projects are set by the teacher, as are the procedural constraints about what happens and when, and the specification of what will count as a good solution. Within this, projects are often most tightly controlled in Year 7 (for example, designing and making an 'Action Sports Trophy' where the size, shape, materials and fabrication of the figure are fixed), allowing more scope for pupil control of the brief in Year 8 (designing a fabric container where the surface decoration is controlled by the teacher while the purpose of the container, and its consequent structure and fastenings, is left up to the pupil) and providing the most open briefs in Year 9 (prototyping new product ideas to exploit a 'new' material on the market, such as plastazote).

Projects are most commonly individual, with all pupils producing similar outcomes in response to the invariably tight constraints operated by the teacher. While formal discussion is limited, pupils often discuss their work in an informal and supportive way. The dominant ethic is transmissional and prescriptive, as pupils are introduced to a wide range of new knowledge and skills for designing, manufacturing, communicating and recording ideas.

Projects are usually accompanied by a folder which introduces formal approaches to recording work. These present a common pattern, often starting with a brainstorm chart of ideas and issues followed by research, initial and final ideas, working drawings, plans for making and a final evaluation.

KS4: Simulated technology — 'This is how real designers work'

At Key Stage 4 projects are almost entirely linked to GCSE courses. Of the two years, Y10 projects are often shorter, more structured, and with teachers taking some control over the context and brief. This was the case in one school where the material was identified as textiles, a time frame of eight weeks provided, the overall theme given as fairgrounds, but the individual brief left for individual pupils to delineate. By contrast, Y11 projects are more likely to be entirely individual. They are viewed as a major project, specified by the pupil and running for the best part of a whole year. The contexts usually have immediate personal meaning and relevance to the pupils. For example, amongst those observed was designing and making a waterproof casing for a personal stereo, designing and making a wheelchair 'jack', and designing and making a sight mount for an air rifle.



As in KS3, most work is individual and again there is often informal collaboration and support from peers. This was the case where two girls, both designing clocks, supported each other in working out the most effective way for each to locate the mechanism. While there are some whole-class teacher inputs, these are often of a progress-chasing nature. Individual support is provided as specific projects or needs dictate. New knowledge and skills are developed in response to addressing design issues within the project. Information is gained from a range of sources the teacher (or sometimes the technician), books, other pupils and individual problem solving and experimentation. In this way the teaching and learning approach is most similar to Key Stage 2.

There is an expectation that pupils will understand the design process (and work through it accordingly) although some pupils exhibit a lack of confidence in this area, seeming to find it difficult to relate the formalised process to the way they actually work.

Summarising the differences

The examples above stereo-type current activities, whereas in fact the boundaries between the key stages tend to blur these distinctions. Nevertheless at the moment it would appear to be unhelpful to talk about design and technology tasks in general, because the teaching and learning agendas appear to be different in each of the key stages. This means that activities are handled in distinctly different ways.

At KS1, 2 and 4 the knowledge and skills required are predominantly identified by the demands of the task itself. In contrast, at KS3 the project is identified as a way of delivering specific knowledge and skills, prioritised in advance by the teacher. This may be due to the traditional focus of KS3 as a foundation course to teach a wide range of skills and knowledge. It could also be possible that the KS3 teacher is doing this in order to provide some remedial action to compensate for perceived short-

comings in the teaching of knowledge and skill in the primary school. While in some cases this may be justified there is the danger that those skills that have been developed by Y6 (problem solving, for example) are jeopardised in the process. To move beyond such a situation, KS2 teachers need to be both clear and confident about the knowledge and skills to be taught to support the development of capability, while at the same time KS3 teachers need to introduce new knowledge and skill, but not to the detriment of that which already exists.

In order to introduce so many new skills, the KS3 teacher often takes a highly directional role. This has an impact on the level of autonomy a pupil can develop and/or exercise. Analysis of the pre-coded data showed this to be particularly true in Years 7 and 8 (see Stables, 1995) where teachers spent over 30% of the activity instructing the pupils. This contrasts with KS1 and 2 where the teacher often has a priority in developing a child's independence, and in KS4, where the onus is on the pupil to take much greater responsibility for his or her own project.

At all four key stages discussion and collaboration at an informal level provide a useful support and development mechanism. However, at KS1 and in particular at KS2, in the absence of a major directional role being taken by the teacher, discussion is an important strategy, being used as a sounding board for the development of ideas and the management of the activity. Again referring to the pre-coded data, Y6 pupils spent over 30 percent of their time discussing their work, as opposed to less than 10 percent in Y7 (*Ibid.*).

While at this stage differences such as those highlighted above, are resulting in a discontinuity of experience for pupils, this is hardly surprising considering the rapidly evolving nature of the subject, the changes in the National Curriculum, and the lack of opportunity to date to step back and to see the bigger picture. It is to be hoped that the commitment to five years of greater stability will allow time to explore the relationships between the contrasting teaching repertoires and enable teachers in all phases to share understandings and jointly provide a more coherent experience from 5 to 16. This is not to advocate an identical diet in each of the key stages, but to promote ways of working that recognise and build on the abilities children have developed through previous experiences.

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