

Illustrative material

An excerpt from the Report of the Working Group on Design and Technology*

INTRODUCTION

1 Following the publication of our Interim Report we sought examples of good practice in the teaching of design and technology in primary and secondary schools in England and Wales. We are most grateful to all those who responded; the development of our ideas has been assisted considerably by their contributions. From the responses, it is clear that the range of activities through which design and technological capability is being developed is extensive. It is also clear that current practice can be developed with minimum adaptation to incorporate the programmes of study and achieve the attainment targets we recommend.

2 Design and technological activities need to be set within a framework which relates to the programmes of study and attainment targets, and which is designed to ensure progression. We provide below some indications of how this could be achieved. In the course of this we refer to activities and tasks of various kinds, but these are to be seen as located within a broad and purposeful framework.

KEY STAGES 1 AND 2

3 In the primary school individual class teachers will clearly be responsible for ensuring that they organise their pupils' work to deliver the programmes of study and attainment targets. It will also be necessary for one teacher to have the responsibility of co-ordinating the work of the whole school, including the use of resources, and provide assistance to other teachers.

4 In establishing the framework for design and technological activities, teachers will need to consider the programmes of study across the attainment targets as a whole: for Levels 1 to 3 at key stage 1 and for Levels 2 to 5 at key stage 2.

5 Much teaching at key stages 1 and 2 is presently based on themes or topics (for example transport, my body, weather, road safety, castles, flight). We assume that this general pattern of curriculum organisation will continue and that teachers will ensure that the matters, knowledge and skills in the relevant

programmes of study are delivered mainly through such topics.

6 In deciding on the range of themes and topics for the key stage, teachers will be seeking to cover attainment targets and programmes of study in several subjects. A number of questions arise about their ordering and planning for progression in relation to those subjects. In the case of design and technology, these might include

- are the themes planned for a time of the year when, for example, they relate to the season, festivals or events in which pupils will have an interest?
- do they provide for progression in the learning of the matters, knowledge and skills and in the kinds of activities specified in the programmes of study for the key stage?
- do they provide for progression in relation to contexts, for example by broadening the range of contexts or by working to greater depths in familiar contexts?
- do they provide opportunities for progression in the programmes of study for the core subjects (maths, science, English) at the same key stage?

7 Within each theme or topic, teachers will need to decide on the particular design and technological activities in which pupils will engage. Important questions to consider here include:

What are the starting points for the activities?

It is important to recognise that the four ATs for design and technology do not describe a linear process which requires the activity to begin at AT1. Identification of needs and opportunities may indeed be the starting point, but equally the activity can begin from use of materials, from an artefact which needs modification, from critical appraisal and in many other ways. With pupils at key stage 1 their experience of handling and working with materials will often be the starting point for design and technological activity. At other key stages, different starting points become more appropriate.

Does the selection of activities provide a well-balanced set of experiences for pupils? Do they include both precisely prescribed tasks and others which are more open, where needs and opportunities have to be identified and met?

The nature of design and technological activities and tasks, as well as their purpose, can vary considerably. Pupils may be provided with a number of different materials and required to investigate their working characteristics or properties (for example how good a thermal insulator is it? how well does it absorb water? how easy is it to shape?) in order to choose or use one of the materials for a prescribed purpose. Amongst other things, they will be learning here about the characteristics and properties of materials, and also probably about the use of tools and equipment, as well as safety considerations. These are important aspects of the programmes of study and can be drawn upon in order to achieve the ATs.

However, this is a very different kind of activity from that associated with a more open-ended task, for example where a problem is identified in general terms and pupils have to design, make and appraise a solution.

Thus, the provision of a home offering shelter from the weather to a family might be a task which invokes a wide variety of imaginative responses from pupils, drawing upon their knowledge of dwellings in the past and in other cultures. A more prescribed activity might focus upon the use of one or two materials and their comparative advantages and disadvantages in a specific situation; or it might limit the task to a concern for energy considerations in a home in a certain location. Both kinds of task, open and prescribed, are important and a judicious, well-planned combination of them will be necessary.

Do the planned activities offer a broad range of contexts?

Both in the attainment targets and in the programmes of study for design and technology, there are requirements that pupils should have experience of designing and making artefacts, systems and environments. The distinctions

between these cannot always be drawn sharply, but they provide an indication of the breadth of outcomes from pupils' design and technological activity that will be assessed. Accordingly, the activities which are planned will need to ensure that an appropriate range of experiences is being provided.

To assist this planning, some kind of 'map' or 'checklist' may be helpful and one possibility for reviewing activities in relation to both range of contexts and type of outcome is given in table 1.

What contribution does each activity make to each of the four attainment targets?

Again, a framework for analysis such as that set out in table 2 for key stage 1 may

be helpful in seeing where activities need redesigning and/or supplementing in order that pupils may achieve the attainment targets.

How do the planned activities fit with the general description of activities and the knowledge, skills and values set out in the programmes of study for the relevant levels?

A 'map', such as in table 3, for key stage 2 might be helpful.

Some method of reviewing what is being covered in activities, such as table 3, will assist decisions about the number of items from each programme of study that are to be 'visited' in a year, and the depth of treatment. It will also make clear if there are aspects of the

programmes of study that are not being touched upon in the planned activities and which might necessitate adjustments to the plans or, very occasionally, direct teaching of the topic.

Table 1

	Context	Home	School	Recreation	Community	Business/Industrial
Outcome						
Personal	A					
	S					
	E					
Other people's	A					
	S					
	E					

[A = Aesthetic, S = System, E = Environment]
At key stage 1, most of the entries are likely to fall into the top left-hand corner of this 'map' of design and technological activities. At key stage 2 it would be expected that more of the 'map' would be covered, with the bottom right-hand corner being unfilled.

Table 3
Key stage 2

Activity	1	2	3	4
Programme of study	Designing and making a postman's bag			
Materials and components	Plastics; textiles; joining; water resistance; wear			
	Energy	Weight		
Business and economics	Costs; market sizes; product life			
Tools and equipment	Sewing equipment			

Table 2
Key stage 1

Activity	1	2	3	4
1 Making a den	Pupils questioned each other about what they wanted; explained their own ideas; had ideas about modifications as they worked.	Pupils drew pictures of their ideas for the den and why they wanted it that way.	Pupils used materials effectively and safely to make the den, and explained clearly what they were trying to do.	Pupils described what they liked and disliked about their den and why.
2				

Table 4
Key stage 1

	AT1	AT2	AT3	AT4
Activity level	1 2 3	1 2 3	1 2 3	1 2 3
1 Teddy bear's bed				
2 Model of garage				
3				

ASSESSMENT AND RECORDING

8 An important aspect of the teacher's work will be concerned with the assessment of pupil' attainments and the recording of this in ways which enable pupils to be placed on a level for each of the ATs. Some form of record keeping such as that in table 4 may be helpful.

EXAMPLE OF DESIGN AND TECHNOLOGICAL ACTIVITY:

KEY STAGE 1 — SHOPS

We give here an example of an activity which might be carried out at key stage 1. It is provided as a means of indicating how such activity can be related specifically to the programmes of study for that key stage.

A traditional and very familiar theme — shops — can provide opportunity for work in design and technology.

The pupils and their teacher might decide to work on a variety of aspects, undertaking a wide range of activities. The following are some examples listed under the subheadings of the programme of study. Not all areas are covered in depth and the examples chosen reflect only one possible approach to the topic.

Materials and Components: exploring, choosing, using and evaluating materials for purposes such as the structure of the shop and its fittings, its goods, bags, display, labelling and clothing for its workers. Pupils might use large construction kits, boxes, paper, fabric, flour, dough, clay, card, paint, markers and various ways of joining and applying them.

Energy: the effect of sunlight on packages and food; temperature control of storage conditions.

Business and Economics: exploring and discussing the roles and responsibilities of shopworkers and customers, the use of money and its exchange for goods, the ideas of work and wages.

Tools and Equipment: choosing, using and evaluating hand and other tools — scissors, brushes, markers, needles — for working with the materials; asking the teacher or adult to perform parts of operations which might be unsafe for the children at this stage, for example cutting holes in a large cardboard box with a craft knife.

Aesthetics: planning, modifying and evaluating the appearance and layout of the shop, its goods, the workers' uniforms, bags for goods, labels and advertising.

Systems: creating systems and rules for use of the shop and testing them out by trying them in practice; for example not more than four children can use the shop simultaneously, staff work on a rota system, the oldest goods are sold first, rotten fruit is thrown away and the premises are kept tidy, the money is organised and profit determined.

Structures: discussing ways of making shelves, counters, trying out the ideas and modifying them until suitably strong and rigid; stand alone advertising and labels.

Mechanisms: looking at a model till or a set of weighing scales for sweets to see how they work.

Exploring and Investigating: visiting shops, talking to their workers, discussing their own and relatives' experiences as customers, comparing their own designs and ideas with other peoples' and those used in reality and so deepening their own understanding.

Imaging and Generating: having ideas about the layout of the shop, drawing and painting them, considering the rota system and different ways of sequencing them, talking about their ideas with other people, suggesting improvements and different ways of making goods for sale.

Modelling and Communicating: making models and samples, role play of customers and shop assistants, paintings, drawings of the shop layout, advertising, drawing up and displaying the class rota.

Organising and Planning: planning the next stage with the teacher or a group, helping to decide who should do each task.

Making: creating the objects required to build and stock the shop and the things needed by its workers and customers.

Appraising: through discussion of their experiences of using the shop. Does the organisation work? Are the bags the right size and sufficiently strong? How much will they hold?

Health and Safety: considering strength, rigidity and stability of structures like counters and shelves. Considering cleanliness of workers' hands and worktops, conditions for storage of perishable materials.

Social and Environmental: discussing how shop workers and customers behave towards each other, why shops are needed, effects of shop waste and litter on environment. What kind of shops do people need? Are the local shops like these? Could they be improved? How?

KEY STAGES 3 and 4

9 In the secondary school one of the purposes of the approach we put forward is to bring together those parts of the curriculum where substantial designing and making already take place and to provide a framework within which the contributions, particularly of teachers of art and design, business studies, CDT, home economics and information technology, can be woven together to form a common experience for all pupils. This should lead to a more effective use of time in the secondary schools.

10 Many of the considerations outlined for key stages 1 and 2 apply with equal force to key stages 3 and 4:

- it will be important to plan for the key stage as a whole with key stage 3 comprising the programmes of study for Levels 3 to 7 across all the attainment targets and key stage 4 covering Levels 4 to 10.
- considerations outlined in paragraph 7 about the starting points, selection, range, contribution to attainment targets and programmes of study, are all important.
- appropriate and practicable assessment and recording procedures need to be developed and be publicly available.

11 A number of factors assume new or greater significance at these later key stages.

- We have identified art and design, business studies, CDT, home economics and IT as having a particularly important contribution to make. There will also be a close relationship with science and

mathematics and the most successful co-ordination will occur when the senior management of the school assume responsibility for the overall planning.

- Although considerations of gender bias and sex stereotyping are important at all key stages, they assume a particular significance in the latter key stages. It will be important in mixed schools to avoid activities, teaching methods and organisation which make it difficult for boys and girls to work together in design and technology, contributing to shared tasks and having access to the same range of experiences.
- Some of the activities in which pupils may be engaged differ from those characteristic of key stages 1 and 2 by being of longer duration (for example at Levels 5 and 6, up to 24 hours; at Levels 7, 8, 9 and 10 from 24 hours to 36 hours). Such extended design and technological tasks have implications for the timetable and for organisation generally. From what we have seen and from other evidence it is clear that the responses of schools to the teaching and learning requirements of design and technology are likely to vary considerably. We do not recommend rotational courses as an appropriate pattern of organisation.

EXAMPLE OF DESIGN AND TECHNOLOGICAL ACTIVITY: KEY STAGE 3

We give here an example of an activity which might be carried out at key stage 3. It is provided as a means of indicating how such activity can be related specifically to the programmes of study for that key stage.

REDESIGN A LOCAL AMENITY HALL TO HELP DEVELOP LOCAL COMMUNITY SPIRIT

Pupils would explore this in the light of the particular context they have observed. From discussions and market research, perhaps involving questionnaires, pupils would identify tasks that could include:

- (a) Redesigning the space around the hall to provide:
 - all-weather play area
 - seating

parking
a more attractive entrance
sports facilities, such as a bowling green or a climbing wall
flower beds and landscaping
wheelchair access
security

- (b) Redesigning the main hall area for multi-purpose use to meet community needs for:

space for users such as pre-school play groups, keep fit classes
sports area with floor markings
public meetings
stage with simple lighting
refreshment area
cloakrooms
curtains, furnishings and black-out facilities
storage

- (c) Explore ways in which the hall might be used, considering running costs and earning potential to make it self-supporting financially, such as:
 - booking/letting system
 - maintenance and security
 - environmental constraints (for example noise from a youth club)

There would no doubt be many other suggestions that would generate design and technological activities. Pupils would need to evaluate their ideas against a range of criteria including feasibility for making — either a model or a final prototype. We illustrate below the way in which at Level 5 the knowledge, skills and values set out in the programmes of study could arise from designing, making and appraising a demountable stage area for amateur productions and front-of-house facilities. This example is not intended to be a comprehensive statement of all the knowledge, skills and values which would be covered, but is simply an indication of how it is possible to teach the level through practical activity. Not all areas are covered in equal depth. When planning activities it is necessary to ensure sufficient flexibility to allow progression and not repetition for individual pupils.

Our example has two parts: (a) the design of the stage and (b) front-of-house facilities for light refreshments.

It is assumed that pupils will take into account such factors as the needs of different user groups, costs, revenue and safety.

Materials and Components

(a) designing the units involving considerations of strength, weight, the ability of the material to take hinges and fixings, paint and fire proofing. The proscenium curtains: comparing durability and visual appeal of the material against cost, ease of cleaning, fading, simulating different lighting schemes.

(b) refreshment facilities: selecting and evaluating appropriate materials to construct a counter on which to prepare sandwiches; cupboards to store tea, coffee, cans of drinks; an area to prepare tea and coffee which is hygienic, easy to wipe down, waterproof and attractive to customers.

Energy

(a) lighting ring with dimmer switches and control system, precautions against heat damage from lamps.

(b) methods of boiling water and heating food, using different fuels and appliances.

Business and Economics

(a) as a result of their investigation of user needs, pupils could prepare a simple budget setting costs of materials against possible income from letting, including cost of maintenance and durability. Judging the quality of the product will include considerations such as ease of assembly and storage and ability to be used for a wide range of activities.

(b) organising stock control procedures, light refreshments sales and secure storage facilities; planning what to charge for refreshments to cover all costs.

Tools and Equipment

(a) selecting appropriate techniques and processes for graphical and modelling work; noting, if the full-sized version were to be built, what techniques, processes, tools and equipment might be required. A range of surface treatments (for example painting or dip coating, sizing, using flame retardants) should be considered.

Aesthetics

(a) the play itself offers wide scope (for example lighting effects, sets, scenery, props, costumes); designing the

proscenium curtains to be attractive and functional (for example sight lines, black out); designing the units to offer different heights and effects.

(b) the design of plates, cups and cutlery for texture, colour, shape; the display of goods on the counter, table cloths and paper napkins; advertising materials; food packaging in order to promote the hall and its ethos.

Systems

(a) analysing a simple lighting system to see how it functions, setting up a scale model system, possibly controlled by a computer; storing and checking back demountable units; stage manager's 'prompt copy' or lighting plot.

(b) rotas, stock control, accounting for money spent and received, security.

Structures

(a) designing the lighting grid, the construction of the units and the proscenium arch using criteria such as safety, ease of handling, stability; designing scale models that can be load tested for stability and strength.

(b) designing food counters, cupboards, secure storage; developing the management structure of the centre.

Mechanisms

(a) designing how the curtains could be operated, the lighting rig raised and lowered.

Exploring and Investigating

- recognising needs in the community, gathering, selecting and organising information in order to discover the range of activities for which the stage area might be used.
- gathering, selecting and organising data (for example about lighting or sound systems)
- costing items for sale and bulk buying
- investigating methods of food preparation and hygiene.

Imaging and Generating

- when designing the lighting rig, focussing on different areas such as the layout of the grid, roof fixings, lamp brackets, safety chains, electrical connections
- comparing the relationships of the material for the proscenium curtains

with their visual effect and how they should draw

- studying the ergonomics and aesthetics of the cutlery and crockery, the style of the refreshment and food preparation areas.
- adapting designs in the light of economic factors and using preferences.

Modelling and Communicating

- communicating ideas as to potential users by sketching and modelling
- exploring and advertising possibilities
- speculating about the flexible use of the stage area and lighting
- speculating about the layout of the refreshment area, its style and flow scheme
- designing cutlery, crockery and napkins
- analysing, comparing and evaluating food storage by written reports and through appropriate charts.

Organising and Planning

- taking account of the time taken to canvass opinion; realistically assessing what can be achieved within the time and materials available
- deciding upon priorities so that an acceptable solution is executed, for example by 'buying in' cutlery and crockery and concentrating on the counter and storage area; or designing the units without a proscenium
- choosing making techniques and processes that are realistic in terms of skill and the availability of equipment.

Making

- producing a range of models, presentation drawings, scale prototypes of the stage units, lighting rig and proscenium designs, with appropriate surface finishes
- modelling the mechanical system for drawing the curtains
- using a range of forming and assembling techniques for the cutlery such as clay mock-ups and wooden patterns for casting
- sewing and weaving for curtain and fabric samples

- preparing food to assess the viability of the storage designs
- building appropriate models to a sufficient standard to explain to and inform potential users.

Appraising

- through their investigation of user preferences assess an acceptable outcome in terms of materials, cost, time and finish
- working in teams, using the opinions of others to evaluate progress
- in the reporting and modelling of ideas develop criteria with users in order to achieve a satisfactory outcome
- appraising commercial food outlets in terms of style, hygiene and storage.

Health and Safety

- ensuring that the public safety aspects of their designs are properly realized
- ensuring that food preparation is hygienic
- identifying potential hazards, such as fumes from heating plastics or casting, and employing proper techniques and wearing protective clothing.

Social and Environmental

- in their investigations taking account of the effects of their design on local residents (for example noise)
- in their designing ensuring that the full range of potential users is considered, for example the elderly, mothers and toddlers, music groups and schools productions.

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