This scheme of work was prepared for the schools in Neath and Port Talbot by a working group led by Bob Cater adviser for design and technology with the Education Support and Improvement Service (ESIS).

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Why are we teaching Design and Technology?

Design and technology is about using skills and knowledge to solve problems. Some of the knowledge and understanding pupils will be taught is specific to the subject but they will also apply knowledge gained in other subjects, particularly science. Through a series of structured projects, the pupils will gain problem solving skills and apply and develop a range of key skills. The subject is motivating and sets exciting contexts for learning.

The Scheme of work

The Scheme has been structured to offer coverage of the National Curriculum programmes of study for Design and Technology bearing in mind the need for progression and continuity. In addition to offering this coverage of the programmes of study, the particular features of this scheme are:

- the attention placed on planning progression and continuity in developing design capability;
- identifying strands in design activity to help develop the skills needed, i.e. drawing, generating ideas, modelling, research, planning and evaluation;
- the incorporation of computer control into the activities;
- the support material included with each of the units.

There are many ways in which schools might plan and deliver the subject. This document offers an approach for schools to adopt if they so desire. In many cases, however, we realise that schools will have projects in place that

work very well. If this is the case, this scheme might offer additional support and ideas to complement existing good practice. If schools decide to structure their own scheme of work it might be useful to maintain the design progression identified in this scheme.

The very nature of technology means that activities in D&T will change and develop as new ideas, materials, processes, software and equipment are developed. Because we are teaching knowledge, concepts and processes related to technology there will inevitably be a change in content as time progresses and schemes of work will need to be updated from time to time.

Key Skills and Common Requirements

Design and technology offers unique opportunities to enhance pupils understanding of Key Skills and the Common Requirements. All activities will contribute to developing language, problem solving and creativity and others contribute to developing skills depending on the nature of the activities. Where there are specific contributions to be made to developing aspects of key skills and common requirements they are noted on the introductory page for those units.

Reading, Writing, Speaking and Listening

Pupils will need to read in order to research information, seek views of others through questionnaires and follow instructions. They should be encouraged to describe, orally and in writing, their observations and views of products and how things work. They will learn new specialist vocabulary and use it in context to describe products and their components. They will also have the opportunity to prepare written descriptions. They should also produce oral and written evaluations of their own work describing how successful it is and, more importantly, how they would improve it if they repeated the activity. They will need to listen to instructions, descriptions and the views of other people.

Numeracy

There are many opportunities to use and develop the pupils' understanding of numeracy. Measuring is important to most activities and in some situations accuracy is becomes more important if things have to fit and match for construction. Various calculations can be introduced in some activities for example, to work out pulley or gear ratios. The structures aspect gives the opportunity to explore geometric shapes in order to discover that the triangle is the only stable flat-frame shape. The understanding and use of nets is an important feature in work related to analysing and designing packaging for a variety of purposes.

In many of the activities, the costing of solutions could be introduced to develop numeracy skills. The materials and components used could be given a unit cost and an overall budget for the project set. Pupils would have to work out the cost of their solution and keep it within a set margin of the given budget. For example, a model could have a budget of £1.50 with a 20% margin and the items required might be costed as follows:

Timber 50p per metre

Electric Motor 35p

Motor clamp 10p

Worm gears 20p each

Gear wheels 10p each

Pulleys 10p each

Card 5p per sheet

Glue 10p per unit (old film container)

ICT

Computers can be used in support of many of the activities, for example, a word processor to record descriptions. The use of computer aided design should be a part of the teaching and a suitable graphics package will considerably enhance aspects of pupils' design work. The section on computer control gives the opportunity to engage in interesting activities to address the computer control strand of ICT that was introduced into the Design and Technology Programme of Study in Curriculum 2000.

The National Curriculum General Requirements

The Curriculum 2000 lays out extended key skills as general requirements. The activities in D&T offer opportunities to help develop the skills and understanding associated with many of these common requirements.

Cwricwlwm Cymreig

Understanding the impact of engineering and technology, both past and present, on the economy and culture of Wales can contribute to this aspect. The study of structures in Wales might examine the reasons for their existence and the impact they have had on the culture and economy of Wales.

Problem Solving

All the pupil activities are designed to encourage the development of problem-solving skills because the activity of designing involves problem solving. Pupils should be encouraged to consider possible solutions before realising their final design. Where appropriate, they should use sketches and modelling to help their thinking. They should be taught to think-through solutions to problems in more and more detail as they progress through Key Stages1 and 2. This will involve the gradual development of the skills associated with the activity, for example discussing, modelling, drawing, producing ideas, developing one idea, planning, and evaluating. If D&T is being taught successfully, groups of children engaged with a project will produce a variety of outcomes. If a class or group produce a number of identical products, then the subject is not being taught correctly. The acquisition of problem solving skills will be valuable to children throughout their lives. One of the most common processes used to develop design/ problem solving capability requires working through the following stages:

1. Brief

The brief is a statement of the problem and needs to be clearly understood. Pupils might be given the brief, or in some cases, prepare their own.

2. Research

Initial research will need to be carried out to get information to make the general brief more specific and to have a better idea how to solve the problem. For example, when the pupils are asked to make a model they will need to find out:

- who will use the product;
- how big the product should be;
- what its maximum cost should be;
- what materials might be appropriate;
- what colours might be used;
- how long they have to make it;
- how much detail should be included.

3. Specification

The design brief is usually quite broad and lacks detail. After some initial research the pupils can produce a specification which gives more detail (it is more specific) about the requirements of the problem.

4. Further research

Appropriate research will need to be carried out to look at solutions that already exist, materials and components that might be needed and to find out about any other skills and knowledge that might be needed.

5. Possible solutions

Pupils should draw and/or model possible solutions. This is the stage at which most creative thinking can occur to encourage pupils to think of several ways of solving the particular problem.

6. Development of the best idea

A final solution will need to be selected and the details for its construction will have to be worked out, for example, sizes, materials to be used, methods of joining things together and colours used. Drawing and/or making models can be used to work out these details. Pupils should be encouraged to plan how

they will make their product, how long it will take and what materials and tools they will need.

7. Make the solution
The final design will be made using appropriate materials, components and construction methods.

8. Test and evaluate the solution
The final product should be tested against the initial design brief/specification and an evaluation made of its strengths and weaknesses. Pupils should be encouraged to discuss their products and to produce written evaluations that identify areas where improvements could be made.

Creativity
The activities pupils engage with will require them to be creative in solving the problems. Creativity is not easy to develop but this scheme of work offers a variety of contexts for pupils to develop interesting solutions in a range of situations. Good design and technology teaching results in pupils arriving at individual solutions to problems. If pupils have to put their name on their products to recognise them then the D&T is not very successful. Solutions should be unique and different.

Personal and Social Education
There will be many opportunities to develop and understand values, attitudes and understanding related to personal and social education. For example, pupils will need to share resources, be aware of the health and safety of others, be aware of the likes and dislikes of others, understand the ecological issues associated with consumerism (depletion of resources, pollution, consumer hype), work with others and listen and respond to constructive criticism.

Classroom Organisation

The organisation of D&T will vary between schools depending on class grouping, resources and teacher confidence. Some aspects of the subject can be taught to whole classes or large groups, for example, product analysis, and particular knowledge, skills and techniques, but practical work will usually occur with smaller groups due to resource limitations and the difficulty of supervising large numbers undertaking practical work. Pupils should become aware of the limitations placed on them by their working surroundings. At all times due regard should be given to health and safety issues related to storing and using tools, equipment, components and materials and safe working practices should be observed at all times.

The time allocated to D&T will probably vary between schools but it should be influenced by the fact that D&T is so rich in opportunities to develop and enhance pupils understanding and use of language, numeracy, ICT and science. Many schools find it more successful to teach D&T every two or three weeks so that the equivalent weekly time allocation can be aggregated to give a more time for the practical sessions. The suspension of D&T activities for long periods should be avoided because this will lead to a loss of progression and continuity and acquired skills and knowledge will be forgotten and have to be re-taught.

Design Support Sheets

The following sheets have been included to enable pupils to structure their designing. They offer a range of options to develop design skills and to allow the pupils to become better designers as they progress through KS1 and KS2. The first sheet is intended to be used at KS1 and can be used to develop pupils drawing skills when they record what they have done.

The sheets numbered 1,2 and 3 are the basis for designing at KS2. As pupils progress sheets 1a and 1b can precede sheet 1, and 2a or 2b replace sheet 2. As pupils develop their evaluation skills sheet 3a can replace sheet 3. The blank sheets headed Initial Ideas and Design Development can be used to allow pupils more space for their design work if they need it. The number boxes should be left blank for pupils to number the sheets appropriately for their project.