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Abstract

During the 1999 summer term a class of 34 Year 3 and 4 pupils at Mappleborough Green C. of E. Primary School took part in a design and technology project to design and make a mechanised model of a mini-beast. The following assignment describes and evaluates the planning, delivery and results of this activity.

The scheme of work for design and technology at Mappleborough Green School is based around termly units of work. Each unit is holistic and contains a range of related activities that direct pupils towards producing a product for a specific purpose. Units provide a focus upon specific materials and components, and are designed to develop the pupils' design and technology capabilities through a range of focused practical tasks, activities in which they investigate, disassemble and evaluate simple products and a concluding assignment in which they design and make a product. The relevant learning objectives in design and making skills and knowledge and understanding are also outlined.

This particular unit focuses on the use of mouldable materials, mechanical components, materials for making frameworks and the creation of a textured finish. It links with work on mini-beasts during the term's science lessons and builds upon the pupils' earlier experience of building a jointed swimming figure at Key Stage 1. It was originally

designed using guidance material from DATA (1995) and Lewisham Education (1996) and was intended to provide a term's work based around a weekly 2-hour design and technology lesson. However, with the introduction of the Numeracy and Literacy Hours, the time available for design and technology has decreased and units are now to be completed within a half term, following guidance from the QCA (1998). This has required the provision of clear lesson objectives in short term planning in order to maintain depth and balance across the unit.

My initial planning for this activity involved looking at plans and notes I made two years ago when I first taught this unit. These original plans were based upon 10 weekly lessons and contained notes about alterations, successes, failures and useful information about the unit, so that I could improve upon it the next time around. I also looked at Unit 11 'Mini-beasts' from the DATA (1995) guidance material for further ideas. Using these sources I needed to produce new plans based around 6 weekly lessons, which would be presented on a 6-week planning grid detailing the key issues, content, activities, organisation, resources and other relevant information for each lesson. Following discussions with colleagues about alterations, we needed to make revised unit schemes and with the need to maintain coverage of the Key Stage 2 Programme of Study, we decided that the main focus for this unit was the study of mechanisms and the creation of a well designed working model or toy. The latter idea would provide a clear aim for the pupils and would also help motivate them, especially as the film *Bugs' Life* was just showing at the cinema. I also decided that the children would produce a small scale model, as opposed to the large scale model suggested. This was mainly because of the amount of time needed to papier-mâché a larger model and because of the problems Year 3 children had in earlier years of combining their construction with a working mechanism. With this in mind I broke the unit down into the following six supporting activities which could be managed over the 6 weeks available and which covered the appropriate knowledge, understanding and skills:

- Activity 1 – Using teaching aids and simple mechanical toys, pupils can investigate the use of mechanisms to produce movement, identify the materials and components used, learn appropriate vocabulary and record their observations and understanding using annotated drawings. This activity provides a springboard for later activities and develops the pupils' knowledge and

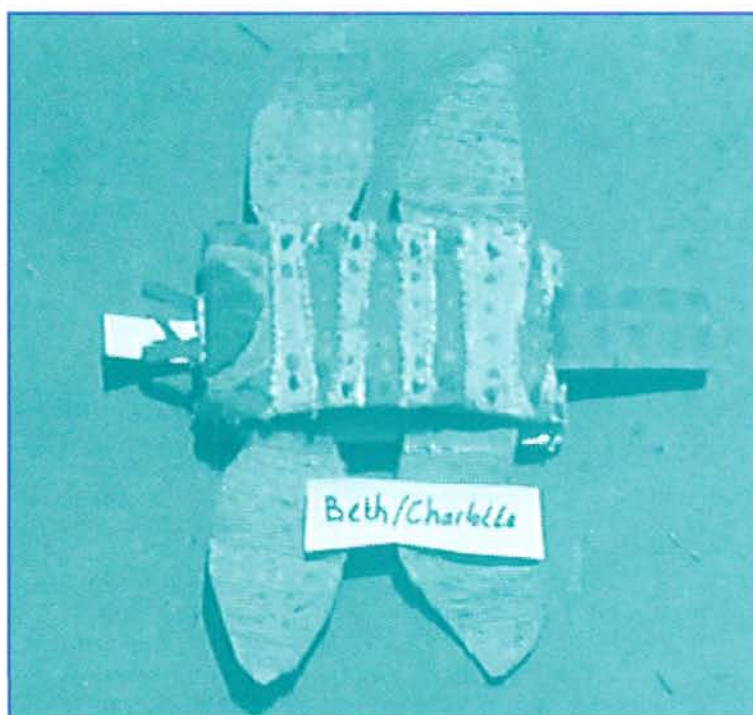


understanding of mechanisms. It also gives an opportunity to teach observation and drawing skills. Pupils also used the CD-ROM 'The Way Things Work' to see in more detail how mechanisms operate.

- Activity 2 – Using templates, pre-cut components, instruction sheets, example working models and split pins, each pupil builds a small mechanical figure with moving arms and legs. Pupils are able to develop their understanding of how materials can be combined to produce effective movement and to practise skills of measuring, marking, cutting and joining.
- Activity 3 – Using a range of flexible and mouldable materials each pupil experiments and creates their own range of example textures mounted on a display sheet, using example teaching aids and photographs of mini-beasts for reference. This activity allows pupils to develop their knowledge of the quality and finished appearance of materials. It also gives them the opportunity to develop some of their design ideas and consider their effectiveness.
- Activity 4 – Pupils observe and draw mini-beasts. They use their work to create initial ideas and a shared final design for their own working model, in discussion with a partner. This provides another opportunity for pupils to develop more detailed design ideas and to consider the series of actions they would need to make during construction.
- Activity 5 – In pairs pupils construct a standard size rectangular reinforced wooden framework as a base on which to fix their working mechanism and on which to build the details of their model. This would ensure that all the components were secure and would provide a solid base to construct the mini-beast's exterior.
- Activity 6 – Pupils work with a partner to construct, finish and evaluate their mini-beast, using paper, card, recycled packaging, glue, paint, masking tape, split pins and corrugate strips. This activity allows the pupils to draw together their earlier experiences, to develop their design ideas and evaluate the construction process. It would finish with pupils presenting their work to the rest of the class and completing an evaluation sheet.

In teaching a mixed age group, containing five Stage 2 and 2 Stage two SEN pupils, I was aware of the need for the strategic use of differentiation to promote the enthusiasm and achievement of all pupils, whilst still

providing a challenging task. This information was included in the last column of the planning grid. To overcome technical difficulties I provided younger and less able pupils with prepared components, templates and materials and gave individual assistance as was required. A parent also came in for three lessons and focused on the needs of the younger age group and helped SEN pupils with writing their design and evaluation notes. I also provided examples of earlier pupils' work, books and photographs of similar products and produced a series of teaching aids showing the stages in the construction of a typical mini-beast model. The staging of tasks was also an important strategy in maintaining pupils' motivation and I made a point of instructing pupils in the small steps they needed to make, in order to complete larger tasks, providing written lists where necessary. More able and older pupils were encouraged to extend their ideas during the design stage, to conduct research at home and to consider the addition of extra movement and details in finishing their product. They were also given less technical support and encouraged to make their own components and to select, cut and shape their own materials. Confident pupils were given the task of instructing and helping younger ones in developing and creating their own ideas and in helping them to complete more difficult constructions. During the final DMA pupils worked with a partner chosen by themselves. This allowed them to support each other during more challenging parts of the model's



construction and the sharing of ideas led to greater invention.

This unit had close links with work in science on the classification of animals and allowed pupils to develop their ideas about the structure of mini-beasts more thoroughly. Observational work using magnifying glasses fed into their drawings and designs and pupils also used the CD-ROM 'Looking at Nature' to explore the range of mini-beasts found in this country. We also looked at a series of illustrated poems which pupils used for handwriting practice and looked at how artists have used drawing to record their observations of different animals. Non-fiction texts used in the Literacy Hour were also used as a way to consider how their final design portfolio could be presented. All these links were combined into a wall display using text, books, photographs, posters and plastic toy mini-beasts donated by the pupils. The completed models were added to this display at the end of the unit.

The organisation of a design and technology unit requires careful consideration of the order of activities, the size of working groups, the availability of materials and the need for teacher support. With these issues in mind activities were taught over the half term in the following manner:

Activities 1 and 2 were integrated together and completed over two consecutive weekly lessons. Following an initial demonstration and explanation of the working of mechanisms and the need for accurate,

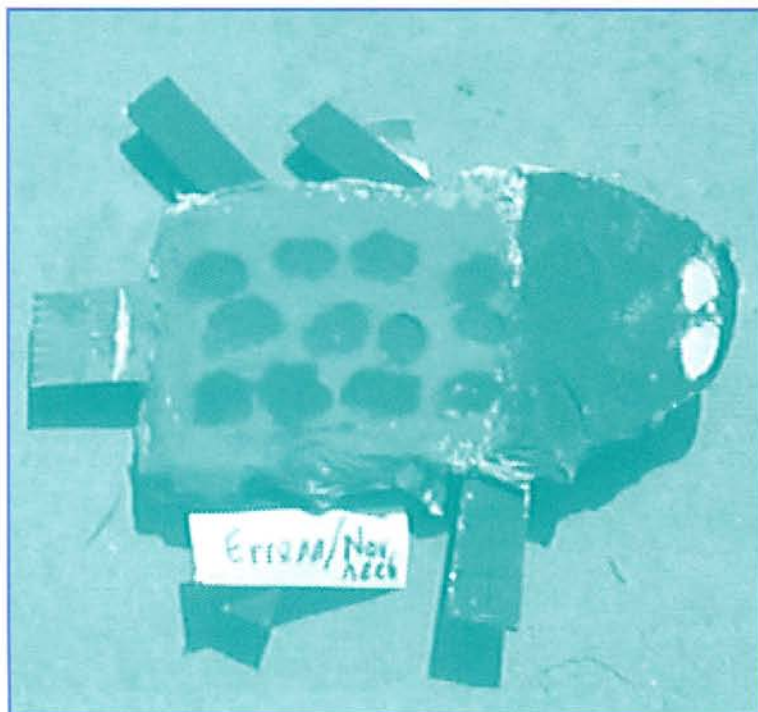
annotated drawings, one year group worked independently on activity 1, assisted by a parent helper who moved around their tables giving a demonstration and explanation of the teaching aids. This then allowed me to give my attention to the group involved in constructing moving figures who were more likely to experience difficulties. It also made it easier to differentiate between the needs of each year group and meant that I needed to prepare fewer resources. The lesson was repeated the following week, with each year group swapping their activity.

Activity 4, drawing mini-beasts, was also integrated into part of a science lesson. Trays containing a variety of mini-beasts, including butterflies bred and brought in by a parent, were rotated around four pupil groups. One group drew, while the others completed independent work. These drawings were then used in the following design and technology lesson.

Activity 5 was planned as an on going activity to be completed by pairs of children within other afternoon lessons. Using clamps, jigs and dowel it took each pair about 10 minutes to complete, following an initial whole class explanation and demonstration.

Activity 6, spread over two weeks, was broken into smaller sections with pupils reporting on their progress, discussing their difficulties and showing their models during each interlude. Each break also gave me an opportunity to refocus the pupils on their aims for that session and to remind them of relevant information. Two empty tables in a corner of the room were used to position the toolboard and glue guns and all work using sharp instruments had to be completed in this area. This made it easier to manage and observe the safe use of tools and provided an area from which to give practical demonstrations. The final presentation formed the basis for a weekly class assembly.

In planning lessons a great deal of consideration was given to the appropriate use and timing of explanations, questioning, discussion and demonstration. All these were important factors in determining the interest of the class, in giving purpose and direction to their work and in maintaining a sense of cohesion across the various activities. Explanations were used at the start of lessons to establish their purpose, to make links with issues raised in earlier lessons and to raise practical matters. They were used at the end of lessons to summarise and evaluate work completed, to look ahead to the next lesson and to reflect upon what we had learnt. Within lessons explanation was used to refocus



D&T PLANNING MINI-BEASTS 1999 YEAR 3/4

KEY ISSUES	CONTENT	ACTIVITIES
Focused practical task	Simple mechanisms. Making joints and linkages. Making skills: cutting, measuring, shaping. Using templates. Considering finish.	Make a moving, mechanical figure. Use a range of pre-cut components or template to shape parts. Join using spit pins, to create an effective mechanism. Draw, colour an appropriate finish.
Investigate, disassemble and evaluate	Mechanisms: how they work and are assembled Combining materials. Drawing and observational skills. Ability to consider, question and examine artefacts.	Use a range of teaching aids to examine the action and construction of a range of simple mechanical toys. Draw accurate sketches, adding notes about the use of materials and their movement.
Investigate, disassemble and evaluate	Observation skills and recording of findings. Drawing and attention to detail. Considering structure, colour, texture and movement.	Observe a range of mini-beasts, recording details e.g. shape, colour, markings, texture and details of joints, direction of antennae. Produce whole drawings and close up sections.
Focused practical task	Using finishing techniques to create a range of textures. Experimenting with moulded paper. Examining characteristics of different finishing materials.	Use paper, glue, card and paint to create a range of textures appropriate for finished model, using earlier observations. Construct on cardboard rectangles, to be mounted on A4 display sheet.
Design and make assignment	Look at structures. Design skills. Making framework and constructing mechanisms. Making and finishing skills. Evaluation.	Develop initial ideas and create a design with partner for mini-beast model. Construct a framework and mechanism. Join together. Construct exterior framework for body. Construct mini-beast, altering as required. Add appropriate finish and texture. Discuss, evaluate and present finished product.

individual pupils, to address shared difficulties and to repeat important technical details. Any explanation worked hand in hand with questioning and guided discussion. I used a balance of open, closed, higher and lower order questions to encourage thought and to check the pupils' knowledge and understanding. Pupils were also encouraged to raise and express their own questions and this proved to be a popular way to stimulate discussion about their experience of the lesson. Design and technology is a practical subject, so hands on demonstrations played a vital role. They were usually presented at the start of a lesson, but were often repeated in a shortened form during its progress in response to technical problems. They aimed at showing pupils ways to organise their work, ways to use materials efficiently, ways to translate their drawings into 3-D, to address safety issues when using tools and to describe new design and construction techniques. It also allowed me to highlight important technical terms and language related to mechanisms and other key issues within the unit.

At the end of the unit pupils organised their drawings, designs, notes and evaluations into a booklet. These were then shared amongst the class and kept along with evidence from other units, as a record of their work in design and technology for this year. At the end of the year pupils took them home, but some examples were photocopied and kept within a school design and technology portfolio. These booklets are valuable assessment documents and provide feedback on pupil attainment and progress. Finished products are also photographed using a digital camera and stored on floppy disk for future reference. This solves storage problems, as pupils' work can go home once recorded. It also means that a carousel of pupils' work can be displayed at parents' evenings using a computer presentation program. During the course of each lesson I allowed time for informal and formative assessment of individual pupils and for evaluation of the lessons content. Assessment of pupils involved marking finished work, discussion and focussed questions based around a particular skill or area of knowledge. Unobtrusive monitoring of

activities also helped me to gain an understanding of the pupils' approach to tasks and how they handle difficulties. Much of the information gained from these activities fed back into the responses I gave to the class and individuals during the lesson, as a way to achieve our intended learning outcomes. It also helped to inform my own practice and I made notes on planning to inform future lessons and to alter unit plans. Some of the evidence gained was recorded on individual pupil portfolios based on criteria from the programmes of study, which I develop over the year for each subject area and which are used to inform my comments on pupils' end of term reports.

Looking back over the half term, the focus of the unit was relevant for this age group. It introduced appropriate skills, knowledge and understanding and provided both the pupils and myself with an exciting design and technology challenge. The shortening of time for design and technology caused some difficulties in covering all the activities I planned and the construction of the mechanism caused some technical problems. I found that it was necessary for me to help each pair to mount their working mechanism onto the framework and this was completed over several afternoon lessons, while pupils worked independently on other tasks. However, the new time scale encouraged me to be more focused on intended learning objectives and this led to more dynamic lessons, more creative use of curriculum links, more effective use of lesson time and greater pupil motivation. It also encouraged me to consider my use of teaching talk and to use explicit, well-defined explanations. I was

concerned that standardising the construction tasks would take away from the inventiveness and creativity of the pupils. However, this approach supported the majority of pupils who found the construction of mechanisms challenging and those pupils who developed ideas of their own, used the framework as a secure basis for their constructions. Activity 3 was not a success. Many of the pupils found the card and paper difficult to manipulate and as a result were unsure of what was required of them. The use of papier-mâché to create the final finish was also time consuming. In the future I will consider the use of coloured card, textiles and decorative products which can provide a more appropriate textured surface. I also want to develop more effective ways for the pupils to develop their design ideas. Many of them found it difficult to think practically about ways to construct their initial ideas and to modify their plans in the light of practical considerations. Despite this, many of the pupils commented on how pleased they were with their final models and the majority of their evaluations, were positive in discussing the problems and decisions they faced.

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