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Abstract

Taking the design and technology unit of work on boats, I have planned and executed six linked and progressive lessons to guide pupils in Year 2 through the designing and making process. The unit of work on boats is integral to the general theme of Transport and runs throughout the half term, linking to all areas of the curriculum. The design and technology unit is initially given a more specific context, by reading the story *Dear Daddy ...*, a story about a girl whose father is working away on a cargo ship. The subsequent unit of lessons offers the pupils the opportunity to learn about different types of boats, their shapes and purposes; investigate and test different materials for their floating properties; sketch designs and draw up an equipment and components list; make prototypes and end product; test and evaluate their boat.

'Design and technology is one of the most exciting areas of the primary curriculum, with its emphasis upon providing opportunities for pupils to design and make objects using a wide range of materials.' (Richardson, 1996)

The process I followed for this unit of work is similar to that suggested by Crampton, K., and Finney, M. (1988), which comprised the following stages: brief, investigation, ideas, evaluating, developing, planning, realisation, testing and final evaluation. It has been suggested that a design process such as this is too basic:

'...such models are too simplistic ... the design process cannot be divided into neat, sequential compartments.' (Kellett and Jinks, 1993.)

However, I found the process to be a good outline for my planning and one that is suitable for use within the primary classroom.

Context

Design and technology lessons, as in other subjects in the curriculum, should always have a context, to ensure that the pupils have a real purpose for the work they undertake.

'A purposeful context can ... be motivating and encouraging.' (Graham and Kelly, 1998: 44)

Using the theme of transport and the reading of the storybook as a context and starting point, it was then suggested to the pupils that, as the father in the story had missed Christmas with his family, maybe the daughter could make a gift to give him on his return.

'A context that is common in school design and technology, is that concerned

with imaginative or fantasy situations. This might involve basing children's designing and making in the context of a story, meeting the needs of imaginary characters...' (Ritchie, 1995: 47)

The pupils decided that the girl in the story could make a model boat as a gift for her father – and this was the catalyst for their interest and enthusiasm for finding out more about boats. 'It is the context which often provides the motivation for successful work.' (Ritchie, 1995: 47)

Session 1

Having read the story and decided on the making of a model boat, we needed to outline a brief. After much discussion as a whole class, the pupils decided that the boat should not only look good, but should be able to float and carry cargo (unifix cubes), just as the boat in the story did. The brief was displayed on the wall, as a reminder of what we were hoping to achieve. It read 'We are going to make boats suitable to give as Christmas presents, that will float and carry 30 unifix cubes.'

The pupils were then introduced to many different types of boats, their names, shapes and purposes, using appropriate vocabulary. English: Speaking and Listening (2b) 'Pupils' vocabulary should be extended through activities that encourage their interest in words, including exploration and discussion...' (DFE, 1995) These were then discussed at length as a whole class, before the pupils worked independently writing about one particular type of boat (see Figure 1). Many model/toy boats, books and posters were available for the pupils to refer to whilst writing about their chosen boat.

Working initially as a whole class enables ideas to be shared and the opportunity to assess which pupils need support or extension activities. This type of discussion also helps the teacher to establish at what level to introduce the topic and to assess what misconceptions exist within the group enabling future plans to differentiate and focus on these areas.

'Knowing about children's starting points is important for any teaching, for only then is there any chance of providing experiences which build upon what a child can already do and understand.' (SPACE, 1993: 75)

Each child's understanding of a subject will be different depending on previous experiences they have had of it. 'What children are capable of learning depends, at least in part,

Opposite:

Figure 1: Writing about one particular type of boat.

Wednesday 17th November Izhaa

Boats

Hovercraft

It carries people and cars.

It goes on top of the water.

It goes very fast on the water.

✓ ☺ 17.11.99

Izhaa: please remember that the letter 'p' sits on the line

with the descender below the line. Also, remember your full stops at the end of sentences.



Group: 4

Date: Wednesday
17 November

Things that Float and Sink

Things we are testing	Our predictions: do we think it will float and why we think so?	What we saw happen	Would we use this to make our model boats?
A plastic pot	For Float	Float	Yes No
Paper	Float	Float	Said No
A plastic bottle	Float	it Floated	Said Yes
Cardboard boxes	Float	it Floated	Yes
Tin foil	Sink Floated	it Floated	No
A ball of plasticine	Sink	it Sink	no
A boat shaped piece of plasticine	Sink	it Sink	NO

Figure 2: The testing process.

on 'what they have in their heads' as well as on the learning context...' (Driver, 1985: 4)

Discussion also links with the 'Speaking and Listening' requirements of the English section of the National Curriculum. Key Stage 1 (1c) 'Pupils should be taught to listen carefully and show their understanding of what they see and hear by making relevant comments.' (DFE, 1995)

Although this session fulfilled the learning objectives, I would make several changes for future use. Too much time was spent discussing boats – a topic with which some pupils were unfamiliar and so they were unable to contribute towards the discussion. Although I had a large number of resources, I introduced them towards the end of the discussion, which was too late. The pupils would have benefited far more from these being introduced earlier on in the discussion, as they would have helped to visually demonstrate what was being said. I would also change the written activity – the pupils would have benefited more from drawing a picture of a boat and labelling the parts to reinforce the new vocabulary used in the discussion, e.g. bow, stern, mast, deck etc.

Session 2

In between sessions, a display of artefacts, models, posters and books had begun to develop. Some of these were collected by

myself, whilst others were contributed by the pupils. This helped to stimulate the pupils' interest in the unit of work and their contributions meant that they were taking ownership of the topic. The display was at the pupils' level to ensure they had access to the information. Using the pupils' own work in the display was an excellent way of validating the work they had done and stimulated their interest in the topic. Hollins and Whitby suggest that including the pupils' work not only improves their self-esteem, but also that it contributes towards a '...dynamic classroom which is full of life...[and] develops a positive working atmosphere.' (Hollins and Whitby, 1998: 159)

In session 2 the pupils were working in groups, to investigate which materials and shapes floated best. They did this by predicting and testing different reclaimed containers and materials and then deciding whether they would be suitable for making the model boats. Key Stage 1 design and technology (2a) 'pupils should be given opportunities to work with a range of materials and components including ... reclaimed materials...' (DFE, 1995)

It was most appropriate for the pupils to work in small groups during this investigative work, as it encouraged discussion, sharing of ideas and expansion of vocabulary. Each group

made notes of their predictions and results and these were then discussed as a whole class at the end of the session. The differences between the groups' results promoted an excellent debate, as each group was keen to give reasons for (and defend!) their own particular results. In addition to providing an opportunity for pupils to express their ideas, discussion at this stage also enables the teacher to move the pupils' learning forwards by introducing ideas and questions to stimulate thought and assess whether they have learnt what was intended. 'Children [should have the opportunity] to express their ideas, prompted by investigation of the real things.' (SPACE, 1993: 65)

In this activity the learning intention was to discover which material types and shapes float best and to develop the vocabulary that comes from this. There was only a group written record, of what the pupils had discovered, so a final discussion was vital to assess what individuals had learnt. '...their [the children's] verbal contributions to the discussion are indicators of their learning and therefore outcomes of the teaching/learning session.' (Proctor, 1995: 111) An outline of the testing process and the results were printed out using ICT (see Figure 2) and displayed together with a large labelled picture of the water tank with materials floating or sinking. Key Stage 1 design and technology: 'Pupils should be given opportunities, where appropriate, to develop and apply their IT capability in their study of design and technology.' Key Stage 1 ICT (2a): 'Pupils should be taught to generate and communicate their ideas in different forms, using text, tables, pictures and sound.' (DFE, 1995)

The connection with science in this session is obvious, as it would link very closely with science topics on 'Floating and Sinking' or 'Forces'. The scientific links were also made with the pupils during the session and they were made aware of what a 'fair-test' was, in addition to following the 'Experimental and Investigative Science' process of doing experimental work, obtaining evidence and considering the evidence – Key Stage 1 (1, 2 and 3). To ensure that all pupils were able to take part in all areas of the investigation – they were arranged in 'mixed ability' groups. Great care was taken to ensure that each had the opportunity to contribute and this was done by my intervention where appropriate. 'The teacher's task ... is to make appropriate interventions which genuinely provide 'scaffolding' for the child's learning' (Ritchie, 1995: 38).

Session 3

Using the knowledge gained in the first two sessions, the pupils were now ready to make suggestions about how they were to design and make their own model boat. This was initially done as a whole class discussion to remind pupils of the different aspects they needed to incorporate into their designs. The discussion again offered me the opportunity to ask specific questions to draw out information from the more able pupils, which would then benefit all the pupils. The pupils were reminded of the design brief before they went away to work individually. Key Stage 1 art (2c) 'pupils should be taught the creative, imaginative and practical skills needed to design and make images and artefacts.' (DFE, 1995) A small group of less able pupils worked on their designs with lots of support from a member of support staff. 'Teacher assistants can be invaluable in supporting both teachers and children in design and technology activities.' (DATA, 1997) A large range of resources was made available to the pupils to aid them in the design process. These included the display, books, posters, model and toy boats, reclaimed materials and the results of their testing from the previous session. I did not provide a ready-made model boat, as I wanted the pupils to think of their own designs, rather than copy mine. Key Stage 1 design and technology designing skills (3a-f) 'pupils should be taught to draw on their own ideas to generate ideas, clarify their ideas through discussion, develop and communicate their design ideas by making freehand drawings and by modelling their ideas in other ways ... identify strengths and weaknesses.' (DFE, 1995)

The pupils were stopped after 30 minutes and asked to take it in turn to explain their design to the other pupils on their table and ask for opinions and suggestions. (I made it very clear that no one was to say that the design was 'good' or 'bad', but that they were to help each other to improve the designs.) After the discussion, the pupils were given a short length of time to make changes or finish their design before moving back to the carpet area. Here the pupils presented their work to the rest of the class, explaining why they had designed their boat the way they had and how they were going to achieve it practically. (It should be noted that some pupils may find this difficult and should not be forced into it – however, all the pupils in this class were desperate to present their designs!) Key Stage 1 art (8f) 'pupils should be taught to review what they have done and describe what they might change or develop in future work.' (DFE, 1995)

Name: Angel
Date: Thursday 15th November

Materials I need to make my boat.

<u>Materials I need to collect.</u>	<u>The part of my boat I will use this material for.</u>	<u>How many I need</u>
1. bottle	hull	one
2. Paint	whole	one
3. straw	oars	Two
4. cloth	Flag	one
5. glue	whole	one
6. corks	whole	one
7. brush	whole	one
8. cardboard	decorations	lots
9. cling film	cover	one
10.		

Figure 3: Form filling.

From these individual reports, I was able to make notes about the pupils' understanding and increasing knowledge for assessment. I was also able to establish whether there were any misconceptions or gaps in knowledge that I needed to revisit at the beginning of the next session. The pupils' work was later displayed on the wall to enable the pupils to share ideas and feel that their efforts were valued. The final part of this session was spent compiling a component and materials list. This was the part of the session that I would change in future. Many of the pupils found filling in a table too confusing and boring (see Figure 3). In future, I would arrange it so that they drew pictures of what materials they needed as this would be both more enjoyable and ultimately more useful, as the pupils would be able to understand it! Over the following week, the pupils collected some of the materials they needed for their boat making, supplementing those in school.

Sessions 4 and 5

There was a great deal of preparation to be done before these sessions could begin. I had decided that I would dictate where the pupils were to work, as I wanted them to work in mixed ability groups. I felt that this would be a supportive way of working, as the less able pupils could then ask for help or simply observe work done by more able pupils and the more able could extend their abilities by putting their understanding into words. Other preparation involved arranging the tables to

ensure a safe working environment (there is no separate design and technology area), preparing resources to ensure that there were enough for everyone and organised in a way that made them easy to use. The Department of Education and Science suggests that the arrangement of materials is an important factor in the way pupils approach their design tasks. 'Where storage is open and items are sorted, children are able to view the possibilities and make informed choices.' (DES, 1991: 27)

During the last session, I had established that the pupils needed help with thinking of ways of joining their components. I began session 4 with a brainstorm on various ways of 'joining' materials together. I had collected a variety of joining supplies e.g. glue, sellotape, string, paperclips, stapler, rubber bands etc., together with different types of materials. As a whole class we then looked at the best ways of joining the different materials together. This proved to be a most important part of the session and the pupils were able to use the information in their designs. Key Stage 1 design and technology (4c) 'pupils should be taught to assemble, join and combine materials and components.' (DFE, 1995)

Before the pupils could start their 'making', we had to establish some ground-rules for working. These were to ensure that the pupils worked safely and in an atmosphere conducive to concentration. The overall

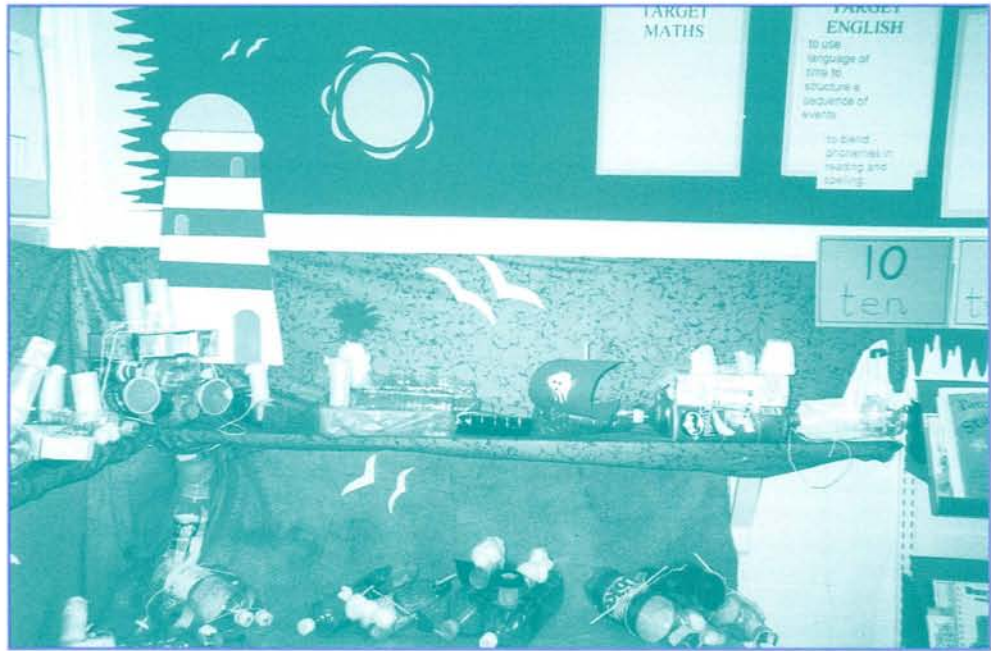


Figure 4: The students at work and their final display.

Date: Wednesday 6th December Name: Izhaad

Designing and Making Boats

One thing I learnt during this topic is

I learnt plastic can float

One thing that is good about my boat design is

I like the yagk pot it helped my boat to float

One thing that I could improve about my boat design is

I should put a ring to put the cube

One thing I really liked doing in this project is

Making the boat is fun.

One thing I am good at in design and technology is

Sticking

One thing in design and technology that I need to practice is

One thing I really enjoyed is

Good to have you have learnt a lot from designing and making your boat.

5/12/19

Figure 5: The pupils assessed what had worked/not worked during the project.

responsibility for the pupils' safety is ultimately the teacher's, though pupils need to be given some responsibility for their own and each other's safety. To empower the pupils to do this, they were made aware of what the dangers were and how to avoid them e.g. use of sharp tools, what equipment should not be carried around the classroom, ensuring that spills are immediately cleared up to avoid slipping etc. Rules of behaviour were also agreed between the pupils and myself before the activity began – there is more chance of the pupils adhering to the rules if they have thought of the reasoning behind them. Key Stage 1 design and technology (5f) 'Pupils should be taught to consider the hazards and risks in their activities and follow simple instructions to control risk to themselves.' (DFE, 1995) It is important to give the pupils feedback about their behaviour and awareness of safety. If the pupils have worked in a responsible and safe way, they should be told so, and given positive reinforcement. In the same way, if there are problems with safety, they need to be made aware of the areas that could be improved.

The initial part of this session was the making of prototypes. In many cases, the pupils used the same materials they were using for their final product – though the initial stage was to assemble the parts without actually joining them permanently. 'The ideas children have for solving a problem or challenge, will need expressing in some concrete form before they can develop it further.' (Ritchie, 1995) Other pupils started making their final product straight away – and then evaluated and modified as they went along. In several instances I intervened where I could see potential problems – I asked the pupils questions to encourage them to think about possible solutions and in a couple of cases, the boats were tested to see if they would float/be stable, to help the pupils to overcome these issues. I did not tell the pupils what to do, but supported them in a way that enabled them to solve problems themselves. Ritchie says pupils should be taught to '...use evaluation as a means of improving the quality of their outcomes and, crucially, the quality of their learning.' (Ritchie, 1995)

The pupils worked co-operatively and in a safe manner and the level of noise was kept to a minimum. They seemed to enjoy this session greatly (even staying to work through their break in many cases!) and made many connections with art – Key Stage 1 art: investigating and making (7c) 'pupils should be given opportunities to explore and use 2 and 3 dimensional media, working on a variety of scales.' Also, (8d) 'pupils should be taught to experiment with ... collage, sculpture, exploring a range of materials, including textiles.' (DFE, 1995) The pupils' work was again displayed, both between the 'making' sessions and when the boats were completed. The pupils loved the display of boats and frequently looked at and discussed the different designs (see Figure 4).

I was able to spend a great deal of time assessing the pupils as they worked in these sessions. I based my assessments on the levels within Attainment Target 2: Making section of the design and technology guidelines. In addition to assessing what design and technology skills and knowledge they had learnt, I was keen to assess how well they shared equipment, helped each other and how aware of safety issues they were.

Session 6

The learning objective of the final session was to discover which designs fulfilled the design brief most successfully. In addition they also examined less successful designs and discussed how these could be modified to improve them. Key Stage 1 design and technology (4f) 'pupils should be taught to

evaluate their products as these are developed, identifying strengths and weaknesses.' (DFE, 1995) Science was again an aspect of this session and the pupils were clear that the conditions for testing must be the same for each boat to make it a 'fair test'. The pupils each tested their own boat to see whether it would float and carry 30 unifix cubes. This activity was greatly enjoyed – especially as there was an element of competition when the pupils were testing to see how many unifix cubes their boats would hold! The pupils were very patient whilst listening to each other, and used appropriate vocabulary when explaining their designs.

'By becoming involved with reviewing their work and recognising progress, children gradually take more responsibility for future learning.' (Harlen, 1993: 166)

I asked each child questions regarding the design, what worked and what did not, how it could be improved, what they liked about their design etc. The final part of this session was to complete a self-assessment sheet. The pupils used their experiences of designing and making their boat to assess what had worked/not worked, what they had enjoyed doing, what they had learnt etc. (see Figure 5) Some found this difficult to do, but with support, all pupils attempted it. Together with the verbal explanations, I was able to assess their understanding from these, and make a summative assessment of the pupils' learning/abilities. I was pleased to discover that most of the pupils were achieving a level 2, whilst six pupils achieved a level 3 and four pupils achieved a level 4. I felt that these results were a real success as these pupils had done little work in design and technology before this series of lessons.

Conclusion

This series of progressive lesson plans was intended as a supplement to the existing information and experiences that the pupils have and move their understanding forward. They were given the opportunity to share ideas through discussion, research and practical activities and critically evaluate their own work and that of others. It was hoped that this method would challenge the pupils' misconceptions in an environment conducive to an open expression of ideas, enabling them to take risks and resolve their own questions. The aim of the lesson plans was that the needs of all the pupils in the group were met through assessment, support and extension work.

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