

Planning a scheme of work – a design and make task for teachers

Introduction

I have often felt that the processes which teachers have to go through in order to develop a scheme of work are very similar to those involved in the designing and making of products. We have a situation or context – the school and department in which we work; from this we can devise a brief – to produce a scheme of work; and we have a range of resources with which to work. These resources include our own skills, expertise and experience, and published schemes and guidelines. As in all other designing we also have a number of constraints and these can include the teaching rooms and facilities, the skills and expertise of the teaching staff and the previous knowledge and experience of our pupils. Having devised our scheme, we implement it and evaluate the outcomes.

A key feature of good designing is that evaluation is ongoing and many teachers will evaluate and modify a scheme of work almost as soon as it has begun to be used. This article describes my experiences of planning and using a Year 10 scheme of work for resistant materials, having taken up a new teaching appointment in September 1996.

There are a number of sources of help and advice to assist teachers in the planning of a scheme of work. During the last five years I have had considerable involvement with the production of the Nuffield Design and Technology materials published by Addison Wesley Longman, and my new appointment provided an ideal opportunity to implement ideas and materials which I have helped to produce. Our decision on the source of help and information was therefore quite easy – all my work for the GCSE course would be based on the Nuffield Key Stage 4 materials. It seems appropriate to set out my experiences and decisions in the Nuffield format used for planning Capability (design and make) Tasks.

The task

To devise, produce, implement and evaluate a scheme of work in resistant materials for a new GCSE group of year 10 pupils.

Task setting

Berkhamsted Collegiate School was formed in September 1996 by the amalgamation of the former long established Berkhamsted School (boys) and Berkhamsted School for Girls, together with their respective junior departments. The school is an independent school situated in Berkhamsted in Hertfordshire and currently has single sex teaching almost throughout. In September 1997 there will be co-education teaching in the sixth form, and in September 1998, a co-educational junior school will be established. It is planned to retain single sex teaching from 11–16 years and departments on the two main sites are likely to remain as separate units. In September I joined the staff of the Design and Technology department of the former girls' school, now known as Kings Campus. My decision to use the Nuffield materials was made easier by the fact that my new colleagues have also made a substantial contribution to the production of the Nuffield materials and we are committed to their use throughout the department.

The department is fairly small, consisting of three full-time and one part-time teaching staff and part-time technical support for food, textiles and resistant materials. There are three teaching rooms, one each for food, textiles and resistant materials. Work in food and textiles has been established for many years, but work in resistant materials has only been established for the last three years. One of my tasks was to continue to enhance and develop the work in the resistant materials area. Currently we teach girls only from ages 10-18.

The aims

- to produce a scheme of work which would meet the demands of the chosen GCSE syllabus
- to produce a scheme of work which could be taught within the restrictions of the resources at my disposal
- to produce a scheme of work which would appeal to, and be of interest to the girls.

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The values

Technical The scheme of work should ensure that pupils have a wide experience of using resistant materials, mechanisms, electronics and structures, with the work matching the demands of the syllabus.

Economic The scheme of work should be capable of being taught within the constraints of the tools and equipment available.

Aesthetic The scheme of work should allow pupils to produce products which are of good quality.

The nature of the product

The Nuffield materials have developed what are termed "Lines of interest". These could be thought of as themes which enable pupils to develop a good balance of designing and making expertise through working in different areas of resistant materials work. Having given some thought to what might be in the scheme or work, I came up with the following lines of interest.

Storage item for Term 1

Automata for Term 2

Body adornment for Term 3

Decisions and justifications

All teachers are aware of the constraints of time in a GCSE course. I am fairly fortunate in that I have two hours and twenty minutes each week and have a fairly small teaching group. Those who have attended a Nuffield presentation about the Key Stage 4 materials, or who have purchased the materials, will know that the project has devised a very useful and effective way of coping with limited time. This is to enter and leave a Capability Task at different points in the process of designing and making. The most important thing is to ensure that there is a balance of the different types of activity, and to ensure that at some stage pupils experience the whole process of designing and making. From Table 1, it can be seen that the first task is a full task where pupils start from the task setting and work through to final product and evaluation. The second task is taken to prototype model stage and the third comes in when initial ideas have been developed. Balance is achieved through the different types of task, and the range of materials and technical components which the pupils will experience.

Table 1 – The Capability Tasks for Year 10

Line of Interest/Capability Task	Nature of the task	Main Materials/ Components
Autumn term	Full task – from task setting to end product	Wood and plastics
Storage		
Storage at home for utility, hobbies, interests, entertainment		
Spring term	Part task – taken to prototype model stage	Technical components, construction kits, card and "light" materials
Automata		
Automata which includes electrical circuit		
Summer term	Part task – developed from design sketches to finished	Range of suitable materials, metals, plastics, semi-precious stones, findings
Body adornment		

My thinking behind the scheme is as follows. The autumn term is often the longest and has fewer interruptions than any other. This gives an opportunity for a sustained period of uninterrupted work and would seem to be the best time for a full task. As it comes at the start of the GCSE course it is also a good time to ensure that pupils experience a full task as a preparation for their Year 11 course work task. My resources were somewhat limited but I knew that I could easily offer work with wood and plastics. I also wanted the pupils to experience some traditional skills in the joining of wood. This led me to the 'Storage' line of interest which met my particular objectives.

For the second task I chose the 'Automata' line of interest since I needed to give pupils the experience of working with mechanisms, electrical and electronic circuits and the idea of control through these aspects of technology. It is often difficult to achieve good quality outcomes when using mechanical systems, especially in the technical aspect of meshing gears and making efficient and effective bearings. The

use of a construction kit, or construction systems which can be linked with resistant materials, is a good way of overcoming these problems. I therefore decided to take this task to prototype model stage, since this linked well with the use of construction kits and technical components. The automata will be clad with card and other "light" materials and thus introduced the idea of modelling a prototype idea.

The third task follows the 'Body Adornment' line of interest. I had two main reasons for choosing this line of interest. The first was to suit the resources available in my workshop where facilities for working with metal are limited although we can cope with the type of manufacturing involved in body adornment. My second reason was that I thought this task would appeal to girls although I have reason to believe that it would also appeal to boys¹. This task will be started at the initial design sketch stage and taken through to the end product.

Table 2 Useful Resource Tasks

Line of Interest/Capability task

Autumn term

Storage

Storage at home for utility, hobbies, interests, entertainment models

Spring term

Automata

Automata which includes electrical circuit

Summer term

Body adornment

Design of item/s of body adornment

Resource Tasks

SRT1 Identifying needs and likes
SRT3 Design briefs and specifications
SRT4 Brainstorming
SRT6 Evaluating
CRT2 Communicating ideas to the maker
SIRT2 Investigating structures through

LIRT3 Seating: a sculpture using useful joints
Making boxes

SRT5 Attribute analysis
SRT7 Systems and control
MRT1 Design challenges 1: Cool oscillations
MRT2 Design challenges 2: Show and turn
CRT1 Communicating ideas to the client
LIRT 6 Automata: Making a dragon
Additional KS3 tasks as required to make up for gaps in knowledge relating to cams, gears, etc.

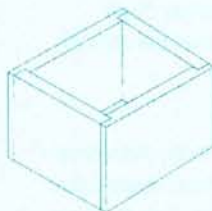
SRT 2 Using a database
LIRT 1 Body adornment 1: Cuttlefish casting
LIRT 2 Body adornment 2: Colouring metals
Making enamelled copper pendants

Unit 3a Storage - box construction

line of
interest
resource
task 3a

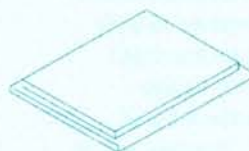
You will develop skills in the use of woodwork joints through making a small box which will be given a painted finish using oil based paint. The outline of the sides of the box are shown in the drawing alongside.

The corner joint is a lap joint. This is formed by cutting away part of one piece to a depth equal to half the thickness of the wood. The other part of the joint fits into this cut out which is called a rebate. For many uses, the joint can be fixed with glue and clamped until dry, but it is also possible to use panel pins for extra strength.



Lap joint

The lid and base of the box are formed by making rebate on all four sides. The base will be glued in place and the top will be left as a loose fit.



Lid/base construction

Learning

To cut and assemble joints which are used for box construction.

Student's book

Making box construction joints, page 208; Finishing wood, page 209.

Timing

3 hours

Equipment and materials

MDF sheet, 6mm or 8mm thick
marking gauge
tenon saw
try squares
bench hook
PVA glue
rebate plane (if available) or use
tenon saw and 25mm wide
wood chisel instead

Type of task

new

Part 1 Working out the sizes

Decide what your box is to be used for. From this work out the sizes up to a maximum of 300mm long, 150mm wide and 100mm high. Work out your cutting list. The chart alongside shows how this should be set out.

PART NAME	NUMBER REQUIRED	LENGTH	WIDTH	THICKNESS	MATERIAL
SIDES					
ENDS					
TOP					
BASE					

T 118 30 x 60

page 1/1

Unit 3a

Figure 1 "Home made" resource task on box construction

Figure 1: A home-made Resource Task

Tools, materials and equipment needed

The workshop which I use was converted from a former science laboratory. The workbenches are about 40 years old and are refurbished double-sided woodwork benches. Vices for use with metal and plastics have been bolted to wooden blocks and these are clamped in the woodwork vices when needed. We probably have the only workbenches in the country with solid Iroko tops, these being made from the tops of the old science benches. We have hand tools for work in wood, metal and plastics and a reasonable range of machines. All the work which I want to do is within the capacity of the room, although silver soldering has to be done with a butane powered blow torch. Hopefully this situation can be altered in the future by the provision of a brazing hearth. A particularly useful feature of the room is an area at the front which allows clean work space for whole

class discussion and where some pupils can do designing whilst others are doing practical work.

The tools and equipment are of course only one part of the resources needed to teach design and technology. Paper based resources, including text books, are essential. One of the most important parts of the Nuffield materials are the Resource Tasks – the focused practical tasks of the National Curriculum. A range of tasks have been produced to support the Capability Tasks as shown in Table 2 but I have found that some of the aspects which I wished to cover have not been included. This is not intended as a criticism of the materials but illustrates the way in which the Nuffield materials can be adapted to suit the needs of a school. One of the Resource Tasks for the storage line of interest is a simple sculpture which teaches pupils about the joints used in frame construction. Having asked my pupils to decide on the type of storage they would like to develop, it was clear that most wanted to do something which involved carcass construction. I devised a "home made" Resource Task on box construction using lap joints for the corners and put this into the Nuffield format. A copy of this task is shown in Figure 1. One of the things which I try to do is to make sure that the materials which I produce for the pupils are of the highest possible quality. It was worth while spending some time on the computer and using drawing and desk top publishing software to produce a fairly close match to the Nuffield format. Having produced a template, other tasks can quickly be put into the same format.

Evaluation

I am convinced that just as pupils need to be taught how to design, so they need to be taught how to evaluate. The Nuffield project has produced a number of Resource Tasks which help pupils to develop skills in evaluation. One of these ideas is a "User Trip" which involved using the product and preparing an evaluation of it. So – what are the results of a user trip of the scheme of work after one term?

Perhaps the most important thing is that the scheme and the Nuffield materials work

well. The previous experience of my Year 10 group in working with wood was limited. The woodworking joints which they cut for their frame construction were the first which they had ever made. The majority came out quite well for a first attempt. One of the joints used is a mortise and tenon joint. Since I had a small mortising machine available, I decided that I would show the girls how to use the machine and let them cut the mortises on the machine. This worked well. Traditional skills taught by traditional teaching – a demonstration – were used to show how the other joints are cut and how a marking knife can be used to give a line to enable vertical paring to be used to make close fitting joints. Another departure from the "official" version of this task was that each girl made her own sculpture rather than working in groups. This was intended to give every member of the group as much time to develop techniques as possible. Figure 2 shows some of the results, which included applying varnish so that a finishing technique was covered.

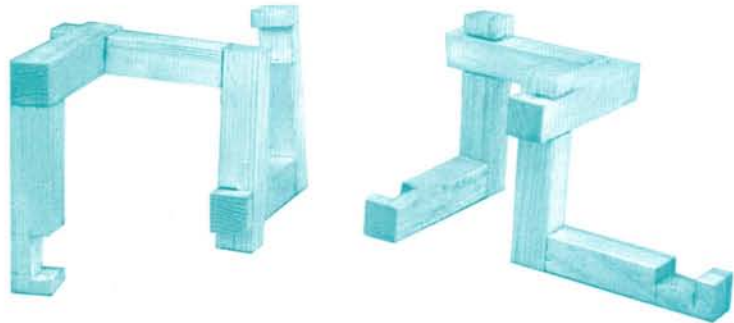


Figure 2: Sculptures from LIRT3

One of the least successful Resource Tasks was that used on identification of needs and wants. On reflection this may be partly due to the fact that I am not very comfortable with this aspect of designing, and probably did not put it over well to the group. The pupils had not experienced this sort of activity before and it might have been better to have used a Key Stage 3 version of the task first. It also shows the need for careful preparation of things which are new to the teacher.

The box construction task also worked well. I used MDF although I do not like it much as a material. It did however enable lap joints to be cut easily, particularly on quite wide pieces of material. Since I have a rebate plane available, the girls made use of this to cut the joints. This enabled me to give a quick tour of the range of bench and special planes available in the workshop. Having only one rebate plane available soon caused a bottleneck so bringing in one from home helped, but not much. I had already planned to do some teaching to develop freehand drawing skills, so this was brought forward and after a short demonstration the group had two different tasks to achieve and the bottleneck was removed. This is where having a clean space in the workshop helps, since the whole group could be properly supervised. To give experience of another type of finish, the boxes were painted using the traditional technique of primer paint, undercoat and gloss. This was useful but did serve to reinforce my view that gloss paint and pupils are not always a good combination! Figure 3 shows some of the results. A range of other Resource Tasks were used including some to develop drawing skills and some to develop knowledge of structures. All of these worked well.

The way in which the girls have approached the Capability Task has been interesting. They all quickly decided on something to do with storage, helped a great deal by the design guide given in the pupils' text book. A wide range of products to do with storage are in the course of production and these include a toy box, storage for spices, a jewellery box and storage in the bathroom.



Figure 3: Products from the home-made Resource Task

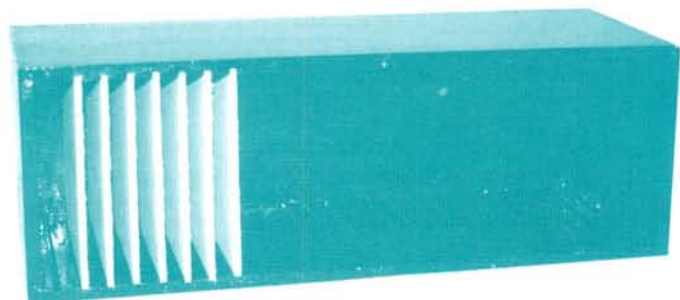


Figure 4: Teaching sequence planning

Figure 4 Teaching sequence for Storage line of interest

Each week = to 150 minutes of teaching time	Introduction to the course. Methods of working, using the Nuffield model. Go through pp 1 - 6 of text book. Discuss and amplify points. Go through GCSE syllabus outline and explain outline of year 10 course and how year 11 will probably work.	Homework Read pp 122 - 125 of text book. Identify possible items of storage which they would like to develop. Read pp 198 - 199. Sketch and name the joints.
Week 1 lesson 2	Introduction to first line of interest - Storage. A storage racking system for collection of medium sized items, CDs, books, etc. Refer briefly to Storage Design Guide on pp 122 - 125 of text book. Introduction to resource task to develop skills and knowledge in the use of resistant materials. Use LIRT 3, Seating - A sculpture using useful joints. Demonstrate marking out, then students set to do marking out. Demonstrate cutting if time.	
Week 2 lesson 1	Continue work on LIRT 3. Demonstrate cutting and fitting of joints. Reminder of safety precautions. Students start to cut and fit joints. Aim to have cutting finished by end of lesson.	Homework Give out copy of KS 3 tool chooser chart (p 214 - 215) Use chart to write description of cutting the joints. Read pp 208 -209 of text book.
Week 2 lesson 2	Finish cutting and fitting of joints, cleaning up, assembly and gluing. Review of finished product. Discussion on what worked well and why and what did not work and why. Go on to discuss identification of needs and likes. Refer to pp 68 - 69 of text book. Start SRT 1 if time and go as far as stage 2 of part 1. Finish for prep.	Homework Finish SRT 1.
Week 3 lesson 1	Review of prep. work. Class discussion and sharing of image boards produced. Individual discussion of stage 4 of part 2. Report back from discussion. Apply finish to sculpture produced for LIRT 3. Towards end of lesson refer to p. 98 of text book. Demonstrate technique.	Homework Read p. 98 of text book. Do a copy of the car drawing. Draw their sculpture and colour in same manner. Read pp 72 - 73.
Week 3 lesson 2	Review of drawings produced for prep. Introduce SRT 3 Design briefs and specifications. Do part 1 in the lesson, working in pairs or threes. Apply second finish coat to LIRT 3. If time, start part 2 in lesson. Finish part 2 and do homework task for part 1 as prep.	Homework Finish SRT 3
Week 4 lesson 1	Review of prep. work. Introduce investigation of structures through models by working through SIRT 2. Demonstrate thread cutting techniques.	Homework Read pp 171 - 176. Make appropriate notes relating to structures.
Week 4 lesson 1	Check understanding of prep work through brief oral discussion and questioning. Continue and finish SIRT 2. Sharing and class discussion of test results.	Homework Read p 206. Make appropriate notes relating to cutting of screw threads.
Week 4 lesson 2	Start additional LIRT, Box construction. Making a small container with lid from MDF board, with lap joints and painted finish. Demonstrate marking out and cutting of parts from one length of material. Students to start to mark out and cut pieces.	Homework Read p 75. Do SRT 4, Brainstorming (modified) for prep.
Week 5 lesson 1	Review of prep. work. Discuss storage areas identified for week 1 prep. and set task of developing an idea. Demonstrate 2 point freehand perspective drawing. Continue with additional LIRT Box construction. Cutting and fitting of joints. Aim to have joints fitted and glued by the end of the lesson.	Homework Start to develop design ideas for storage product. Read pp 188 - 195

Figure 4: Teaching sequence planning (continued)

Week 5 lesson 2	Class discussion and review of initial ideas produced for prep. Sharing and discussion of outline ideas produced so far. Demonstration of making lid and base of box. Students then start to make the lid and base. Aim to have base glued on by the end of the lesson, and the two parts of the lid glued together.	Homework Continuation of development of design sketches. Take to constructional details stage.
Week 6 lesson 1	Review 1. Sharing of ideas produced for prep. Teacher input on constructional methods shown, and where ideas need to be developed. Individual help and advice to pupils during practical work. Practical work to finish lid, clean up and sand box. At appropriate time, demonstration of application of oil based paint using traditional method of primer/sealer, undercoat and top coat. Start painting if time.	Homework Continuation of development of designs. All details to be finished by next lesson.
Week 6 lesson 1	Input/reminder of orthographic projection. Do an orthographic projection drawing of a simple object, using drawing boards and T square. Work from actual object using help sheet.	Homework (over 2 sessions) Do CRT 2, using squared paper.
Week 6 lesson 2	Do orthographic drawings of storage product. Also apply undercoat to box.	Homework Finishing off of working drawing and materials list.
Week 7 lesson 1	Show examples of card and balsa models of some designs for storage products. Start to make a scale model of their design. Whilst practical work is in progress give individual help and advice on designs as required. Apply top coat of paint to box.	Homework Give out hand out on time plans. Produce time plan for making their design
Week 7 lesson 1	Finish making of model. Apply colour to simulate finish. Review time plans on an individual basis.	Homework Read pp 188 - 195 Make appropriate notes relating to materials.
Week 7 lesson 2	Introduction to practical work. Need for care and attention to be given to logical and careful working and safety when working. Remind pupils that designs may need to be modified as practical work proceeds. Need for modifications to be recorded. Time plan and designs to be collected in for assessment. Brief demonstration of any practical techniques required. Before end of lesson go through Focussed Case study 3, House of Card. Set to read and do tasks for prep.	Homework Read pp 62 - 63 Focussed Case study 3, House of Card. Do the tasks.
Week 8 lesson 1	Review of practical work done in last lesson. Brief discussion of any problems found and ways in which they might be resolved. Continuation of practical work. Introduce idea of evaluation through User Trip. Look at p 91 of text book and discuss. Set SRT 6 (part 1) for prep.	Homework Do SRT 6, (part 1)
Week 8 lesson 2	Review of practical work done in last lesson. Continuation of practical work. Introduce idea of evaluation through Winners and losers activity. Look at p 91 of text book and discuss. Set SRT 6 (part 2) for prep.	Homework Do SRT 6, (part 2)
Week 9 lesson 1	Review of practical work done in last lesson. Continuation of practical work. Show examples of presentation drawings. Set CRT 1, Communicating ideas to the client for prep.	Homework Do CRT 1
Week 9 lesson 2	Review of prep. work. Review of practical work done in last lesson. Continuation of practical work.	Homework (2 sessions) Do a presentation drawing of their finished product.
Week 10 lesson 1	Continuation of practical work. Aim to have practical work finished by the end of the lesson.	Homework (2 sessions) Finish presentation drawing.
Week 10 lesson 2	In pairs girls to carry out user trip of the product which they have made. Each girl to do her own and then to do partner's product. Discussion and sharing of ideas.	Homework Write up of evaluation. Presentation of design and written work.

T.H.B. 4-9-96

References

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(1996) *Nuffield Design and Technology Product Design, Product Design Resource Task File, Product Design Teacher's Guide*, Essex: Longman

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The last product raises an interesting question since the girl concerned wants to make a toothbrush holder using a combination of copper and aluminium alloy. This of course is a major departure from the main materials which I intended pupils to use. One of the advantages of the Nuffield approach is that all the group will have covered the same knowledge content through working on the Resource Tasks. Most of them will have experienced the majority of the skills which they need to make their storage designs, and, where required additional skills can be covered through individual or whole group demonstrations. I have decided to let the toothbrush holder design continue and to give the necessary demonstrations of techniques to the whole group as required. Since these will be concerned with hollowing and planishing of copper sheet, the time taken for demonstrations will be limited and will be good preparation for the body adornment task in the summer term. As far as I am concerned it will not matter that one pupil in the group uses a different range of construction techniques, since I know that they will all have covered the same techniques through their work on the Resource Tasks.

One of the crucial things about a scheme of work is whether it fits into the time available. My user trip of my scheme shows that it has failed on this point, since by the end of the autumn term we have only just begun on the making of the storage designs, rather than finishing them. The main part of this delay was caused by underestimating the time needed to complete the two practical Resource Tasks. As part of my planning, I had worked out a teaching sequence for the term. Although I have been teaching for a long time, I found this very useful, both in the initial planning and as a reminder for my weekly planning. A copy of this is shown in figure 4. It is important to realise that a teaching sequence such as that which I have used is a guide and not a straitjacket. The teaching sequence also illustrates a technique which I first used many years ago – of using homework time to do much of the planning and design work. This means that the time in school is used mainly for practical work and the workshop resources are used well and not left idle whilst design work is being done. The use of homework

time can be difficult in some schools where pupils may not be as well motivated as they might. Its use as a time saver can, however, be invaluable. The use of Resource Tasks enables design work for the Capability Task to be carried out in parallel with practical work on Resource Tasks and thus designing and planning skills are developed alongside practical skills.

By way of conclusion, having got part way through the user trip, it is important to see if the scheme of work meets the aims and values set out earlier. I feel that the aims have been achieved. The scheme meets the demands of the syllabus and can be achieved within the constraints of the resources available. So far the girls appear to be interested in the work and are working hard to produce good results. In terms of the values, a large part of the syllabus will be covered during the year and things which are not covered in Year 10 can be covered through other Resource Tasks in Year 11. The range of outcomes which the group has produced are variable, but given the previous experience of the group are quite acceptable.

I have been pleased with the way in which the planning has paid off, and my experience has reinforced my view that the availability of "off the shelf" curriculum materials can be adapted and used in a flexible manner to make it easier to produce good results. I hope to provide further information in the future to show how the pupils build on the experience of their first term.

Note

1. Anecdotal evidence – conversation at NEC D&T Exhibition 1994 – head of technology of boy's comprehensive and head of technology of girl's independent school overheard describing how all their pupils enjoy RMRT5 – stripy jewellery a KS3 Resource Task.