

Unit 7B(ii) Designing and making for yourself

Focus: resistant materials

About the unit

The main aim of this unit is to develop pupils' understanding of designing for manufacturing, and of manufacturing itself.

In this unit, pupils tackle a design and make assignment (DMA) on the theme 'Puzzle in a box', in which they design and make an interesting gift or puzzle to go inside a box. To help them develop their design ideas they make prototypes, models or mock-ups, which they evaluate and modify before starting to make their final product.

Pupils gain the knowledge, skills and understanding they need to carry out the DMA successfully through product evaluation activities and focused practical tasks. They:

- use simple prototypes, models and mock-ups to evaluate design ideas
- use a range of cutting, shaping and forming processes, *eg sawing, line bending*
- use specified hand-tools to cut and form materials safely

There are also opportunities for pupils to:

- use and understand a one-off production technique
- use prototypes, models and mock-ups in the manufacturing process
- learn that designers evaluate and modify their prototypes before starting a production run
- learn that marketing is an important part of designing and making a product

Where the unit fits in

This is one of three resistant materials units that focus on designing: this one in year 7 on designing for yourself; one in year 8 on designing for clients; and one in year 9 on designing for markets. These units ensure progression in understanding about designing.

This is part of a series of three units in year 7 on designing and making for yourself; there are equivalent units, with similar learning outcomes, on food and textiles. Together these units are expected to take 15–24 hours. It is important that the department plans as a team so that pupils are able to draw on knowledge, skills and understanding from across the units to reinforce their learning and avoid unnecessary repetition.

The product evaluation activities and focused practical tasks from unit 7C 'Using ICT to support researching and designing' could be integrated into this unit. Pupils could carry out the DMA from this unit or one of those from unit 7C ('stencils you like' or 'maze game').

If you choose not to teach this unit, then plan to include the essential activities identified by the symbol ■ as part of another unit.

If this unit is used later in year 7, then pupils should be able to complete more of the optional activities.

Expectations

At the end of this unit

most pupils will: carry out their own research by collecting information and use what they learn about products that are produced commercially when developing their own ideas; consider the needs or requirements of users; clarify their ideas through discussion, labelled sketches and modelling (using ICT where appropriate) and give reasons for choosing between ideas; work safely and with some accuracy when using a range of resources, addressing risk, noting any hazards to themselves and others, and identifying ways of controlling risks; compare their product with the design specification and identify what is working well and what could be improved

some pupils will not have made so much progress and will: carry out research and use their findings when developing ideas; illustrate alternatives using sketches or models and choose between them; measure, mark out and cut given materials with some accuracy during modelling and production; note safety equipment used, *eg goggles*, and identify its purpose; identify some successful, weak or problematic parts of their work

some pupils will have progressed further and will: carry out their own research using sources other than those provided by the teacher, and use their findings about existing products when developing their own ideas; make effective use of models/prototypes to explore and test their thinking; use formal drawing methods to communicate their intentions; use a wide range of techniques during trialling and production, *eg measuring, marking out, cutting, forming, joining, finishing*; devise simple tests to evaluate the effectiveness of their product in use; evaluate how they have achieved their original design proposals and make recommendations for further development of the product

Prior learning

It is helpful if pupils have:

- selected appropriate materials, tools and techniques
- measured and marked out accurately, *eg when marking out and drilling a hole*
- used tools for cutting safely and effectively
- used a drill to make an off-centre hole in a wheel
- made a prototype to test their ideas
- produced step-by-step plans for making their design, including materials and tools needed
- used appropriately a variety of temporary and permanent joining techniques
- used tools safely and accurately to construct a simple frame
- selected appropriate tools, materials, components and techniques for a task, taking into account constraints, *eg time or the availability of resources*
- identified the main stages of making

Pupils should have gained the above knowledge, skills and understanding in years 5 and 6, through unit 5A ‘Musical instruments’, unit 5C ‘Moving toys’, unit 6A ‘Shelters’, unit 6C ‘Fairground’ and unit 6D ‘Controllable vehicles’ in the key stage 2 scheme of work, or similar projects.

Language for learning

Through the activities in this unit, pupils will be able to understand, use and spell correctly words relating to:

- processes, *eg cutting, shaping, forming, marking out, glueing, vacuum forming, risk analysis, hazard identification*
- tools, *eg try square, marking gauge, odd leg callipers, bench hook, backsaw, hacksaw, abrafile, fretsaw, coping saw, tin snips, butt joint, glue, dowel, rivet, screw, nut and bolt, mould, hand-tools*

Speaking and listening – through the activities pupils could:

- ask questions to gain clarification and further information, *eg Why...? How...? What...? What then...?*
- answer questions using relevant evidence or reasons

Resources

Resources include:

- a collection of marketing techniques, *eg posters, TV and radio adverts, brochures and leaflets, advertorials, packaging, photographs of point-of-sale displays*, used for particular products, *eg cars, games, puzzles*

- case studies, *eg videos, photographs, books*, explaining the product development process for a range of well-known products
- case studies or examples of user research
- case studies showing a variety of prototypes being used in the product development process
- materials, tools and equipment for prototyping, modelling and making mock-ups
- materials, tools and equipment for cutting, shaping and joining
- useful websites, *eg*
 - www.dtonline.org
 - www.warwick.ac.uk
 - www.engc.org.uk
 - *sites of manufacturers containing marketing information, such as* www.deskartes.com; www.imirp.demon.co.uk; www.jjengineering.co.uk; www.rapitypes.co.uk; www.sanders-prototype.com

Future learning

Pupils could go on to further units on designing and manufacturing in a variety of materials, *eg unit 8B ‘Designing for clients’, unit 8E ‘Producing batches’*.

Out-of-school activities and homework

Pupils could:

- present an illustrated story of the design, production, promotion, use and disposal of one product
- collect advertisements that show the ways in which one product has been marketed
- find examples of new products that have been designed to meet recent consumer needs and explore questions about them, *eg What has caused the demand for these products, such as changing lifestyles? What demand might there be in the future for new products? Which different groups of people might want or need them?*
- practise techniques for finding out about users that they know nothing about, *eg looking at the situation in which a product will be used, talking to users*, to establish what people like and dislike and the range of different people who will use the product
- collect pictures of different products under two headings: ‘high-volume production’ and ‘one-off production’
- find examples of how prototypes, models and mock-ups (in a variety of materials) are used

Links with other subjects

- Mathematics: links with work on shape, space and measures when pupils present dimensional plans, use 2-D representations of 3-D objects and analyse 3-D shapes through 2-D projections and cross-sections.
- English: developing effective questioning techniques when carrying out market research.
- PSHE: discussing lifestyles, priorities and values as part of setting the scene for the DMA.

Learning objectives

Pupils should learn:

Possible teaching activities**Learning outcomes**

Pupils:

Points to note**DESIGN AND MAKE ASSIGNMENT (DMA)**

- to design, make and evaluate a prototype before starting a production run, by applying the knowledge, skills and understanding they developed during the product evaluation activities and focused practical tasks

Set the pupils a DMA in which they:

- use prototypes, models or mock-ups in the manufacturing process
- evaluate and modify their prototypes before starting a production run
- use a range of manufacturing techniques and hand-tools to cut, shape and form materials safely

This might involve ‘setting a scene’ in a way that includes discussion of lifestyles and pupils’ priorities and values.

Example

This example DMA has been written so it can be copied and given directly to pupils. Further details and contexts can be added, as appropriate.

Puzzle in a box

Many small gifts, games and puzzles are produced to appeal to a particular age group or type of person, eg ‘Kinder Eggs’ contain a surprise gift for young children inside a chocolate egg. The ‘BB Box Company’ has asked you to make a box of a maximum size 100mm x 100mm x 100mm. They would also like you to design an interesting gift to fit inside the box. Decorate the box to suit the design of the gift and finish it in a suitable way.

- identify the particular requirements of the task and the design criteria to be met, and take these into account when putting together a design brief
- draw upon their understanding of familiar products
- discuss design ideas with potential users
- develop a prototype and use it as the basis for drawing up a manufacturing specification
- present ideas as dimensioned plans and patterns
- suggest alternative approaches if first attempts fail
- use CAD/CAM (computer-aided design and manufacture) to ensure consistency and accuracy, where appropriate
- are aware of the types of things they can do to control risk
- evaluate their products against the criteria and suggest design improvements



Health and safety – during the making process, pupils should learn to recognise hazards, assess risks and take steps to control the risks to themselves and others

PRODUCT EVALUATION

Organise a range of activities that give pupils an opportunity to:

- understand the need for a product and judge how well it meets that need
- understand how marketing techniques, changing fashions and social conformity help to create ‘need’
- suggest what criteria might have been used when designing and making a particular product
- consider how users interact with the product

■ essential activities

○ optional activities

Learning objectives

Pupils should learn:

- what a designer needs to think about (design criteria) when designing and making
- how marketing, changing fashions and social conformity play a part in creating and determining 'needs'
- that products are designed to meet particular needs and how to judge the extent to which they do so
- how the user interacts with the product and how to clarify people's needs and wants

Possible teaching activities

- Discuss with the pupils the design, production, promotion, use and disposal of one product, *eg a toy*. As part of the discussion, pupils could consider the questions
 - *What or whose needs or wants might have been considered at each stage from design to disposal?*
 - *How might they have been identified?*
 - *Who might have been consulted?*
 Extension: some pupils might also consider *How might the design have been developed? What alternatives might have been considered? Who or what influenced decisions?*
- Collect examples of ways in which products, *eg toys and games*, have been marketed. Discuss with the pupils
 - *What assumptions have been made about the product's buyers and users?*
 - *How is it sold?*
 - *Where is it sold?*
 - *How much does it cost to buy?*
 - *How much do materials and production cost?*
 - *How is it promoted and packaged?*
 Extension: some pupils might also consider *Does this product have an identity or image? How has this been achieved? Does the promotion target a particular age or group of people?*
- Product development should respond to the needs and demands of consumers in order to maintain sales, *eg meeting the demand for products that are environmentally friendly*. Discuss with the pupils one product that has been designed recently to meet consumer needs. *What has caused the demand for this product, eg changing lifestyles?*
Extension: some pupils might also consider *What demand might there be in the future for new products? What might different groups of people want or need?*
- Designers usually have to design for people and companies they know nothing about. Ask the pupils to consider how they can find out what the users will want or need. Discuss with the pupils techniques for finding out, *eg looking at the situation in which the product will be used, talking to buyers and users to find out what people like and dislike, finding out the range of people who will use the product.*

Learning outcomes

Pupils:

- list the criteria that a designer might have thought about, *eg cost, size, safety, maintenance, product life, how it is used, colour, texture, materials*, when designing and making a particular product
- know the role that marketing, fashion and social conformity, *eg peer pressure*, play in creating 'needs'
- describe the need for a product and judge how well it meets that need
- select and use appropriate techniques, *eg questionnaires, observation, interviews*, to investigate the situation in which a product is used and the needs and wants of users

Points to note

■ essential activities

○ optional activities

Pupils should learn:

Pupils:

FOCUSED PRACTICAL TASKS (FPTs)

These practical tasks should focus on the knowledge, skills and understanding outlined in 'About the unit'. They should give pupils an opportunity to practise any new skills they will need during the DMA, *eg using specified hand-tools to mark out, measure and cut plywood or MDF.*

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| <ul style="list-style-type: none"> ■ how to use a range of cutting, shaping and forming processes, <i>eg sawing</i>, and how to use specified hand-tools to cut and form specific materials safely | <ul style="list-style-type: none"> ■ Set up activities which give the pupils an opportunity to practise a range of cutting, joining, shaping and forming processes.
<i>For example, pupils could:</i> <ul style="list-style-type: none"> – <i>mark out across materials and along materials, eg mark plywood using a try square and sharp pencil, mark along softwood with a marking gauge, mark along mild steel using odd leg callipers</i> – <i>saw straight lines by hand, using a bench hook and backsaw or a vice and hacksaw</i> – <i>saw curved lines, using a coping saw, abrafile or fretsaw</i> – <i>cut aluminium, using tin snips</i> – <i>use permanent joining techniques, eg rivets, dowel rod and glue</i> – <i>use temporary joining techniques, eg screws, nuts and bolts</i> – <i>carry out vacuum forming, using a prepared mould</i> Pupils could practise these skills by making simple items quickly, <i>eg key fobs, tie racks, bookends, printing stamps, photograph frames, laminated jewellery, coat hooks, containers</i> | <ul style="list-style-type: none"> ■ select and use specified hand-tools and equipment to cut, join and form specific materials safely and accurately, and to use appropriate forming materials |
| <ul style="list-style-type: none"> ■ to use prototypes, models and mock-ups when designing | <ul style="list-style-type: none"> ■ Show the pupils how to produce prototypes, models and mock-ups in a variety of materials, <i>eg use mouldable materials to shape part of a product, use cardboard to model the pieces of a puzzle, use construction kits and scrap materials</i>, and ask the pupils to practise some of these techniques. | <ul style="list-style-type: none"> ■ know how to make their own prototypes, <i>eg a cardboard prototype</i>, models and mock-ups and know when these will be most useful |
| <ul style="list-style-type: none"> ○ about the use of prototypes, models and mock-ups in the manufacturing process | <ul style="list-style-type: none"> ○ Show the pupils how prototypes, models and mock-ups are used in the manufacturing process. Use videos, case studies or real examples, <i>eg toys and games</i>. Talk with the pupils about how a puzzle or gift could be batch or mass-produced, and what tools and equipment would be needed. | <ul style="list-style-type: none"> ○ give simple examples of how manufacturers have used prototypes, models and mock-ups during the process of designing and making, and give reasons why these are used |
| <ul style="list-style-type: none"> ○ that designers evaluate and modify prototypes before starting a production run | <ul style="list-style-type: none"> ○ Discuss with the pupils how designers evaluate and modify prototypes before starting a production run, and show them how they can use their own prototypes to evaluate and modify their ideas. | <ul style="list-style-type: none"> ○ use a prototype to test a design idea, <i>eg make a simple puzzle from inexpensive material to evaluate the design</i> |



Health and safety – the use of saws to cut wood, plastic or mild steel must be carefully supervised at all times. Pupils should be asked to identify possible dangers when using saws and to say what they would do to minimise the likelihood of injury

Use of ICT

- If a CNC (computer numerically controlled) milling machine is available, pupils could cut out channels in a pre-cut block, using CAD/CAM software, to produce a printing stamp. It is possible to incorporate some of the activities from unit 7C 'Using ICT to support researching and designing' into this unit.

■ essential activities

○ optional activities

Learning objectives

Pupils should learn:

- what is meant by 'one-off production' techniques

- that marketing is an important part of designing and making a product

Possible teaching activities

- Discuss with the pupils different volumes of production and talk about how their design ideas might be influenced by the number of products they are going to make. Talk about the differences between one-off production and prototypes, *eg for toys*.

- Ask the pupils to discuss, in groups/pairs, how marketing techniques are an important part of designing and making a product. Ask them to collect data on their target market for a new product, *eg on the types of puzzle that different 'clients', such as siblings, parents and grandparents, would play with*. This will give the pupils another opportunity to reflect on other people's value judgements when designing.

Learning outcomes

Pupils:

- describe one-off production and give examples of products that have been made in this way
- describe the difference between a prototype and a one-off product, and know when it is appropriate to make each
- know that there is a marketing campaign when a new product is launched
- understand that designers identify target markets for new products
- use questions based on design criteria to practise basic market research techniques

Points to note**Language for learning during market research**

- Give groups of pupils a product of interest to their age group and ask them to practise question techniques for market research. Ask them to devise questions based on their earlier product evaluation activities, to find out what people in their age group might want, *eg in terms of colour, ease of use, design and special features*. Different question formats, *eg open, closed, rank order questions that allow for choice*, could be used. Pupils could then try to ask these questions of others in their class and write a brief report making recommendations.