

Unit 9E(i) Ensuring quality production

Focus: food

About the unit

The main aim of this unit is for pupils to make and produce their work in quantity.

In this unit, pupils tackle a design and make assignment (DMA) on the theme ‘Bread batch production’, in which they present a prototype of a new bread that can be manufactured on a larger scale. They make their product in volume, reflecting similar processes to those that might be used commercially. They develop quality assurance procedures, and use production aids, *eg moulds, weighing and measuring devices, moulded baking trays*, where appropriate, to improve the quality of their manufacturing.

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

- learn how food products are manufactured in volume
- find out about the main commercial food manufacturing processes, *eg unit processes*
- learn how quality assurance systems, *eg HACCP (hazard analysis and critical control points)*, are used to ensure safe food production and storage
- use an increasing range of hand-tools and machine-tools, including mixers
- use CNC (computer numerically controlled) equipment, *eg CAD/CAM (computer-aided design and manufacture)*, to support making and to control production, where appropriate
- adapt their methods of designing and making to changing circumstances

There are also opportunities for pupils to:

- increase their understanding of how ICT influences manufacturing in industry, and how computer-controlled systems are used in industry and commerce
- find out about the concepts of quality assurance, systems and procedures

Where the unit fits in

This is one of three food technology units that focus on making and producing: one in year 7 on designing and making for yourself (unit 7B(i)); one in year 8 on producing batches (unit 8E(i)); and this one in year 9 on ensuring quality production. These units ensure progression in understanding about making and producing in quantity.

This is part of a series of three units in year 9 on ensuring quality production; there are equivalent units, with similar learning outcomes, on resistant materials and textiles. Together these units are expected to take 10–15 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.

This unit can be combined with unit 9B(i) ‘Designing for markets (food)’. In this case, teachers can choose the DMA from either unit. If this unit is used towards the end of year 9, pupils should be able to complete more of the optional activities. The unit can be used as part of the end-of-key-stage assessment.

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

■ essential activities

○ optional activities

Expectations

At the end of this unit

most pupils will: carry out their own research and use their findings about products that are produced commercially when developing their own ideas; consider the needs of a range of users; clarify their ideas through discussion, drawing and modelling, and give reasons for choosing between ideas; work safely and accurately when using a range of resources, avoiding risks; draft a production plan, identifying risks and precautions, noting any hazards to themselves and others, and identifying ways of controlling risks; try out and test ways of producing and finishing their product in volume and explain their choices; use techniques skilfully during production, including measuring, forming, cutting, mixing, processing and finishing; set up tests to evaluate the effectiveness of their product in use; compare their product with the design specification and identify successful, weak or problematic parts of their work; suggest ways to improve the product’s design or production

some pupils will not have made so much progress and will: carry out research and use their findings when developing ideas; choose between available materials, tools, equipment and techniques and explain their choices; suggest the next steps for planning and constructing their product; measure, cut, mix and finish various materials/ingredients reasonably accurately and safely during production, noting safety equipment used and its purpose; identify successful, weak or problematic parts of their work

some pupils will have progressed further and will: carry out their own research using sources not provided by the teacher, and use their findings about existing products when developing their own ideas; use prototypes effectively to explore and test their thinking, and use formal drawing methods to communicate their intentions; organise their work during trialling and production, and carry it out accurately and consistently, including measuring, forming, cutting, mixing, processing and finishing; devise tests to evaluate the effectiveness of their product in use, relating their findings to the purpose for which the product was intended; evaluate their product against a broad range of criteria and demonstrate how they have achieved their original design proposals

Prior learning

It is helpful if pupils have:

- used a variety of techniques to prepare and process foods
- considered safety and hygiene when handling food
- learnt how ICT can be used to plan their making, inform the making process, or make products using CAM (computer-aided manufacture)
- used processes, tools, equipment and techniques to make with some precision, showing that they understand their uses
- taken account of the technical requirements needed to make a product
- justified their decisions about the selection of materials/ingredients and methods of making, recognising the global dimensions of life-cycle analysis
- revised and consolidated their understanding of health and safety regulations

Pupils should have gained the above knowledge, skills and understanding in years 7 and 8, through unit 7B(i) 'Designing and making for yourself (food)', unit 8C 'Using ICT to support making' and unit 8E(i) 'Producing batches (food)', 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:

- designing, *eg CAD, computer-aided design, HACCP, hazard analysis and critical control points, quality control, quality assurance, production plan, scaling up*
- making, *eg batch and volume production, CNC, computer numerical control, CAM, computer-aided manufacture, standard component, bulk, wastage, reliable, identical, production line, unit operations*

Speaking and listening – through the activities pupils could:

- ask different sorts of questions to extend thinking and refine ideas, *eg Does that imply that...? Does that mean...? Would we need to...?*

Writing – through the activities pupils could:

- understand the effect of different aspects of formality, *eg passive verbs, third person, abstract nouns*

Resources

Resources include:

- products, or pictures/photographs of products, that are made using different manufacturing methods
- useful websites, *eg*
 - www.bakersfederation.org.uk
 - www.foodfuture.org.uk
 - www.foodtech.org.uk

Future learning

This unit has links with the key stage 4 programme of study. In particular, pupils will learn:

- 2a) to select and use tools, equipment and processes effectively and safely to make products that match a specification
- 2b) to use a range of industrial applications when working with familiar materials and processes
- 2c) to manufacture single products and products in quantity, applying quality assurance techniques
- 2d) to use CAM in single item production and in batch or volume production
- 2e) to simulate production and assembly lines, including the use of ICT
- 4c) how materials are prepared for manufacture and how pre-manufactured standard components are used

(Extracts from the D&T key stage 4 programme of study)

Out-of-school activities and homework

Pupils could:

- collect small, low-cost items or pictures of them and identify how they have been manufactured. They could compare similar products, one high cost and one low cost, giving reasons for the differences in price
- collect as many different kinds of one product or pictures of them as possible to show the diversity of the product, *eg different breads*. They could record their findings as sketches, notes, pictures or a chart
- find out what products were produced in the local area, where the resources came from, and where products went to. Teachers should explain that a century ago most manufacturing took place where there was a local supply of raw materials and people with the necessary skills
- find out how to make manufacturing more environmentally friendly. Teachers should explain that some manufacturing industries can use huge quantities of raw materials/ingredients and resources, *eg electricity, water*, and also produce waste products

Links with other subjects

- Science: links with unit 8C 'Microbes and disease'.
- ICT: using CNC equipment, *eg CAD/CAM*, the influence of ICT on the manufacturing industry and commerce.
- English: drawing up a specification, writing report(s).

Learning objectives

Pupils should learn:

Possible teaching activities**Learning outcomes**

Pupils:

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

- to make a product in volume, using similar processes to those used commercially, 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 make a product in volume using similar processes to those used commercially. They should develop quality assurance procedures and use production aids, *eg moulds, patterns, CAM*, where appropriate, to improve the quality of their manufacturing.

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.

Bread batch production

A bread manufacturing company is concerned that bread does not appeal to young people. It has asked the pupils in your school to investigate and design a new bread product aimed at young people. Present a prototype of your design and think about how the bread would be produced on a larger scale. You might try out batch-production methods with a group in the class. You will need to think about the kinds of materials/ingredients and processes that are most suitable when many identical products have to be made.

- select information sources, deciding which will help them with ideas for their design
- seek the opinions of potential users of the product
- draw up a detailed design specification that specifies criteria to take into account, including aesthetics, function, reliability, maintenance, quality, and health and safety implications
- write full technical reports
- produce plans that specify the exact details to make a product in volume
- work within the constraints, considering and reflecting on the design criteria as closely as possible
- prioritise and reconcile decisions on materials/ingredients, time and production
- adapt methods of working to changing circumstances
- use competently hand-tools, mixers and computers, if appropriate
- take action to control identified hazards to themselves and others
- review the extent to which their product meets the design specification at appropriate stages of the development

Language for learning when writing design specifications and technical reports

- Remind pupils of different approaches to language in design specifications and technical reports, *eg how to link abstract concepts to descriptions of function, construction, finish, materials/ingredients, making processes; the effect of passive and active verb constructions, first person and third person.*
- It is useful to have a range of design and technical documents available for pupils to refer to as models. Some pupils may need more structured frameworks to enable them to produce effective documentation.

Language for learning when reviewing a product outcome

- Ask pupils to carry out a mutual review in groups of two or three. The reviewees begin by explaining progress and suggesting the particular points that they want feedback on. Reviewers ask questions to help the reviewees refine their ideas.

■ essential activities

○ optional activities

Pupils should learn:

Pupils:

PRODUCT EVALUATION

- Organise a range of activities that give pupils an opportunity to:
- find out how everyday products are made and how identical products are achieved in spite of complex production processes
 - understand how some processes used in school are the same as those used in industry
 - find out how ICT influences manufacturing in industry and how computer-controlled systems are used in industry and commerce

- | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ■ how everyday products are made in high volume, how identical products are achieved at the end of a complex production process, and why these products are often cheaper than if we were to buy the raw materials/ ingredients and to make them ourselves | <ul style="list-style-type: none"> ■ Discuss with the pupils how items similar to those used for the DMA are produced cheaply and in quantity so that they all come out the same. As part of this discussion, the pupils could be asked the following questions <ul style="list-style-type: none"> – <i>What kinds of materials/ingredients, tools, equipment and processes are most suitable when a large number of identical products have to be made?</i> – <i>How serious would it be if one product was below standard?</i> – <i>How is the process broken down into unit operations?</i> ■ Discuss with the pupils how to investigate methods of producing an item and how to collect data when testing to help choose between two methods. | <ul style="list-style-type: none"> ■ describe what must be done to ensure that when bread is made, it is identical each time |
| <ul style="list-style-type: none"> ○ that some small-scale processes used in school are the same as those used in industry for high-volume production | <ul style="list-style-type: none"> ○ Discuss with the pupils what specialised tools and equipment they can use to simulate small-scale processes and high-volume production, <i>eg using a bread-maker or mixer</i>. Point out how it is the same as the manufacturing industry uses. If it is different, ask them <i>Why do you think this is?</i> | <ul style="list-style-type: none"> ○ give two examples of how the process used in school is the same as that in industry |
| <ul style="list-style-type: none"> ○ that materials/ingredients, tools and equipment have to be adapted and controlled carefully to assure quality during high-volume production | <ul style="list-style-type: none"> ○ Introduce the pupils to a case study of making bread in high volume. Ask them to compare the process with making bread at home. Discuss with the pupils any differences in the materials and ingredients used, <i>eg the use of standard components, precise specifications for raw materials/ingredients, additives, and any differences in processing and handling, eg the size of the batch made; when, how and why quality and safety checks take place; the use of machinery and hand finishing; how waste is managed.</i> | <ul style="list-style-type: none"> ○ explain three ways in which the process of domestic bread making is different from that of commercial, high-volume bread making |

■ essential activities

○ optional activities

Learning objectives

Pupils should learn:

- how HACCP is used for safe food production

Possible teaching activities

- Show the pupils a case study, video or photographs from the food industry and talk to them about the risks and hazards involved in handling food. Talk to them about how food must be prepared, handled, stored, transported and sold in appropriate conditions and temperatures, *eg the coldest part of the fridge should be at a temperature of 0–5°C*. Ask the pupils to identify how food manufacturers create and maintain food preparation areas that are clean and free from contamination. Discuss how they will apply safe working practices when preparing food in the classroom, particularly when dealing with a food product that has a limited shelf life, *eg bread*.
- Discuss with the pupils the role that quality assurance procedures, *eg HACCP*, play in ensuring the production of safe food products. Use examples to show the pupils how flow charts are used, where critical control points are identified, and how food products can be checked during all stages of production, to ensure safe production and storage of food products. Ask the pupils to develop a simple flow chart for their bread product.

Learning outcomes

Pupils:

- know what is meant by HACCP, and how to produce a simple flow chart for a bread product, identifying relevant safety and quality checks

Points to note**FOCUSED PRACTICAL TASKS (FPTs)**

These practical tasks should focus on the knowledge, skills and understanding outlined in 'About the unit'. They should give the pupils an opportunity to practise any new skills they will need during the DMA, *eg how to use an increasing range of hand-tools and equipment*.

- how to use working characteristics of materials/ ingredients and components

- Give the pupils recipes so that they can practise making bread and a range of bread products, *eg pizza, fruit bread*. Ask them to explore the use of different ingredients, *eg white and wholemeal flour, rye flour, eggs, sugar, dried and fresh yeast*, and production processes, *eg baking, boiling, grilling, frying*.

- modify a food product by altering the ingredients and production processes

- simple techniques that can be used to ensure products are identical at the end of a complex process

- Ask the pupils to use a commercial bread mix to produce a batch of bread rolls that are identical in shape, size and appearance. They can do this in groups as a production-line simulation. Discuss with them the techniques they could use to get the rolls to come out the same, *eg measuring accurately, weighing when dividing rolls, using cutters or moulds, timing, shade colour charts for visual checks*. Ask the pupils to try different techniques and say which work best, and to identify the advantages and disadvantages of working as a team during production.

- explain which techniques worked best in the production of identical bread rolls and why

■ essential activities

○ optional activities

Learning objectives

Pupils should learn:

- how to use CAD/CAM to support making and control production, where appropriate

Possible teaching activities

- Discuss with the pupils ways that ICT can be used to help them with quality production, eg
 - *use a flatbed scanner to record surface features and the texture of samples of bread rolls*
 - *use software to generate a flow chart to help plan making and identify safety and quality checks*
 - *use virtual manufacturing sites, such as www.foodtech.org.uk, to interact with the world of manufacturing*
 - *use computers to monitor weight and temperature*

Learning outcomes

Pupils:

- know when computers can help control production and why this is important to ensure quality

Points to note

■ essential activities

○ optional activities