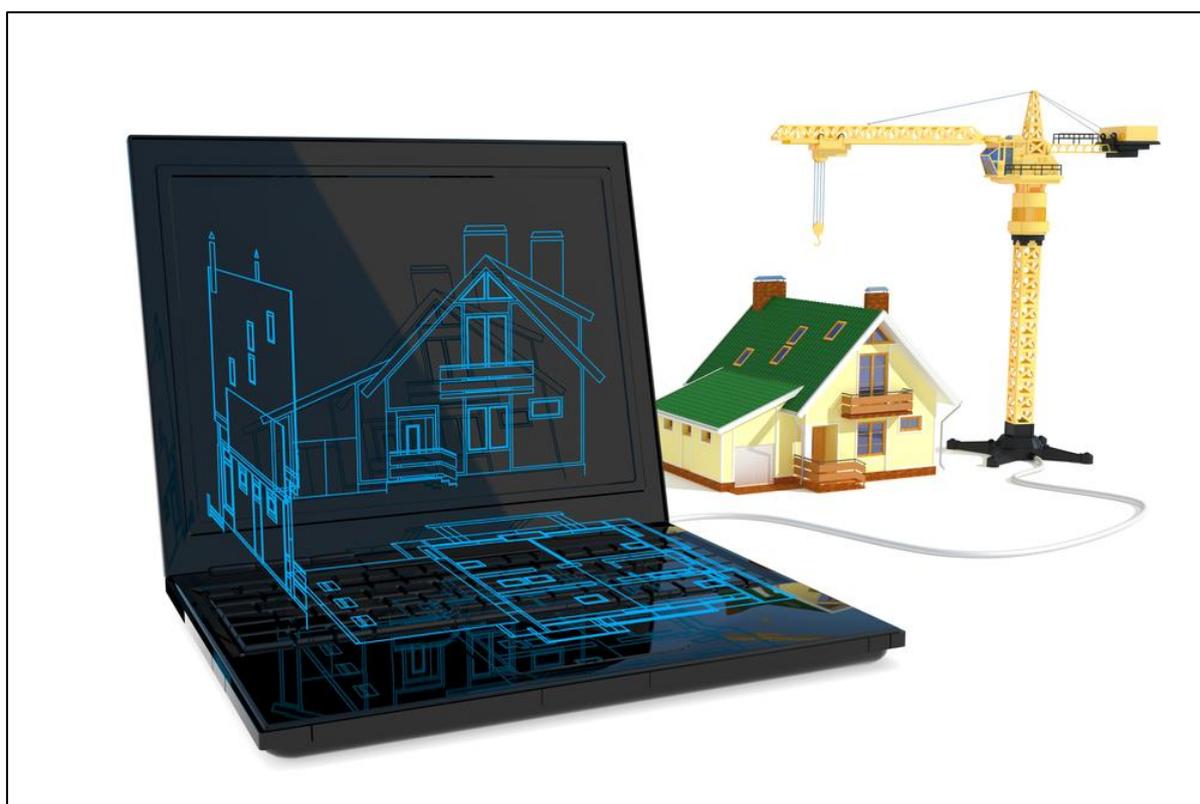


# National 3 Design and Technology Course Support Notes



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Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

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# Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the National 3 Design and Technology Course. They are intended for teachers and lecturers who are delivering the Course and its Units. They should be read in conjunction with the *Course Specification* and the *Unit Specifications* for the Units in the Course.

# General guidance on the Course

## Aims

As stated in the *Course Specification*, the aims of the Course are to enable learners to:

- ◆ develop skills in producing and interpreting sketches, drawings and diagrams
- ◆ develop skills in practical model making and construction
- ◆ develop skills in testing and simple evaluation of models
- ◆ apply safe working practices in a workshop or similar environment
- ◆ develop knowledge of basic engineering ideas

This Course will also give learners the opportunity to develop thinking skills and skills in numeracy, employability, enterprise and citizenship.

## Progression into this Course

Entry to this Course is at the discretion of the centre.

However, learners would normally be expected to have attained some relevant skills and knowledge through prior experience.

## Skills, knowledge and understanding covered in this Course

This section provides further advice and guidance about skills, knowledge and understanding that could be included in the Course.

The skills and knowledge will be developed throughout the Course. The table below shows where there are significant opportunities to develop these in the individual Units.

Skills and knowledge	Graphics for Design	Designing and Modelling	Constructing and Testing
skills in producing, with guidance, sketches, drawings and diagrams	✓	✓	
skills in interpreting simple sketches, drawings and diagrams	✓	✓	✓
applying, with guidance, a simple design process		✓	
following, with guidance, a simple problem solving process			✓

basic skills in constructing (or simulating) and testing simple models		✓	✓
safe use of a range of tools and equipment in a workshop or similar environment		✓	✓
basic knowledge of simple engineering ideas			✓
an appreciation of sustainability issues		✓	

## Progression from this Course

This Course or its components may provide progression to:

- ◆ National 4 Graphic Communication
- ◆ National 4 Design and Manufacture
- ◆ National 4 Engineering Science
- ◆ Skills for Work Courses in Energy and in Engineering Skills
- ◆ National 3 Practical Craft Skills

and ultimately, for some, to:

- ◆ National Certificate Group Awards (NCGA) in related areas
- ◆ employment, apprenticeships and/or training
- ◆ National 5, Higher and Advanced Higher in technological subjects

## Hierarchies

**Hierarchy** is the term used to describe Courses and Units which form a structured sequence involving two or more SCQF levels.

Although there is no direct hierarchy between National 3 Design and Technology and any single National 4 Course, there is a fallback arrangement in place with National 4 Graphic Communication, National 4 Design and Manufacture and National 4 Engineering Science. This means that a learner who gains all three Units of any of these National 4 Courses, but fails the Added Value Unit, may be awarded the National 3 Design and Technology Course, provided they have been entered for the National 3 Course. Other combinations of Units from these Courses may also be valid.

<b>National 4</b>	Graphic Communication	Design and Manufacture	Engineering Science
<b>National 3</b>	Design and Technology		

It is important that any content in a Course and/or Unit at one particular SCQF level is not repeated if a learner progresses to the next level of the hierarchy. The skills and knowledge should be able to be applied to new content and contexts to enrich the learning experience. This is for centres to manage.

# Approaches to learning and teaching

Design and Technology, like all new and revised National Courses, has been developed to reflect Curriculum for Excellence values, purposes and principles. The approach to learning and teaching developed by individual centres should reflect these principles.

Learning in this Course should be primarily practical, hands-on and experiential in nature.

Whole-class, direct teaching opportunities should be balanced by activity-based learning on practical tasks. An investigatory approach is encouraged, with learners actively involved in developing their skills, knowledge and understanding by investigating a range of real-life and relevant problems and solutions related to engineering, design and how things work.

The use of a variety of active learning approaches is encouraged, including peer teaching, individual and group presentations, role-playing and game-based learning with pupil generated questions.

Learning should be supported by appropriate practical activities, so that skills are developed simultaneously with knowledge and understanding.

Practical activities and investigations lend themselves to working together, and this should be encouraged. Co-operative and collaborative learning approaches support and encourage learners to achieve their full potential. Unlike individual learning, learners engaged in these strategies capitalise on one another's resources and skills — asking one another for information, evaluating one another's ideas and monitoring the group's work. While “working in a group” is not specifically identified as one of the skills for life, learning and work for this Course, and therefore not assessed, it is a fundamental aspect of working in the engineering and design industries and so should be encouraged and developed by teachers.

Problem-based learning (PBL) is a strategy which will support a learner's progress through this Course. This method may be best utilised on completion of an Outcome or a topic where additional challenge is required to ensure learners are secure in their knowledge and understanding and to develop the ability to apply knowledge and skills in less familiar contexts. The teacher sets a task which requires learners to apply their knowledge to solve a problem. For example, learners could be asked to design the handle of a toothbrush and a toothbrush holder which is suitable for people with arthritis. Learning through PBL develops a learner's problem solving, decision making, investigative skills, creative thinking, team working and evaluative skills, and is appropriate in any of the Units of this Course.

Throughout the teaching of this Course, the stimulation of learners' interest and curiosity should be a prime objective. Where possible, locally relevant contexts should be studied, with visits where this is practical. Guest speakers from industry and further and higher education can be used to bring the worlds of engineering and design into the classroom. Where this is not possible, online resources, such as STEM-Central, subscriptions to design or engineering

magazines and online news articles, may be valuable alternatives. Computer-based simulations also encourage learning as learners can manipulate and investigate complex systems without requiring access to expensive equipment.

Assessment activities, used to support learning, may usefully be blended with learning activities throughout the Course.

For example:

- ◆ sharing learning intentions/success criteria
- ◆ using assessment information to set learning targets and next steps
- ◆ adapting teaching and learning activities based on assessment information
- ◆ boosting learner confidence by providing supportive feedback

Self- and peer-assessment techniques should be encouraged wherever appropriate.

Assessment evidence may be produced in a variety of formats including presentations, web pages, digital photographs, digital video, podcasts and blogs, and these can be stored by the learner (or teacher) within a proprietary e-portfolio, or simply by storing them in a secure folder.

Learning about Scotland and Scottish culture will enrich the learners' learning experience and help them to develop the skills for learning, life and work they will need to prepare them for taking their place in a diverse, inclusive and participative Scotland and beyond. Where there are opportunities to contextualise approaches to learning and teaching to Scottish contexts, teachers and lecturers should consider this.

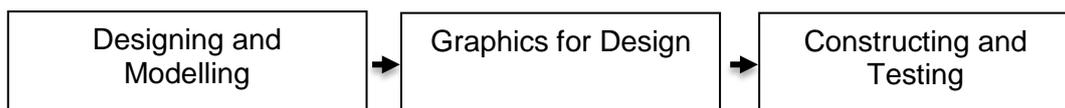
### **Sequence of delivery**

The sequence of delivery of the Units within the Design and Technology (National 3) Course is at the discretion of the centre and the models suggested below exemplify possible approaches which may be developed to suit individual circumstances and resources.

#### **Example 1: Sequential delivery of the Units**



or:

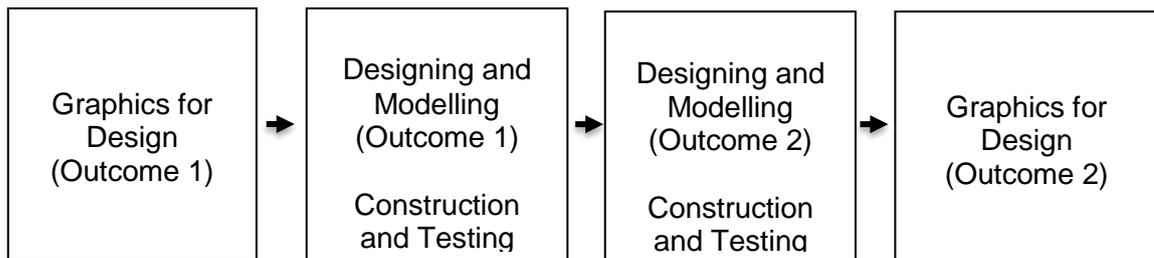


In this example, the Units are delivered sequentially, beginning with either Graphics for Design, or Designing and Modelling. Both of these Units provide a natural starting point into a design process.

The physical model (or models) developed during the Design and Modelling Unit or the Constructing and Testing Unit may be based on the drawings produced during the Graphics for Design Unit.

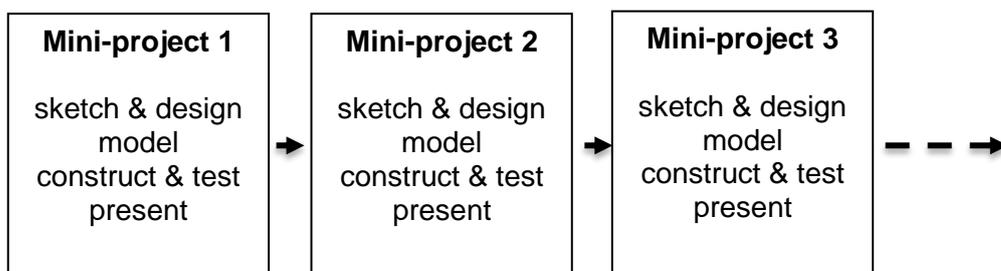
Alternatively, the three Units may be delivered as completely independent blocks of learning. If so, the Units can be used as tasters for further study of Graphic Communication, Design and Manufacture, and Engineering Science at National 4 level.

**Example 2: Integrated delivery**



In this approach, the whole Course may be delivered around a common theme or context. A broad challenge could be set to design, model, construct and present a solution to fulfil a purpose. This approach is best suited to learners who have already demonstrated that they have adequate skills from prior learning. It provides the learners with an integrated approach to all three Units and shows the connectedness between them and promotes the connection with the world of work.

**Example 3: A series of mini-projects**



Similar to example 2 above, but instead of one major challenge, the Course would be delivered around a series of smaller mini-projects.

Each project, which could be undertaken by an individual or a group, could include a sketching and design phase, a modelling and constructing phase, followed by testing and modifying, leading to a final presentation. Each new project would be more challenging than the previous one, consolidating and developing skills in a progressive way. Evidence for assessment could be gathered from one or more projects. It is likely that early projects would be used to support learning and skill development, with later projects being used to provide evidence for Unit assessment.

For example, one possible mini-project could be the design and testing of a toothbrush and holder. The shape and texture of the handle and holder could give a basis for the learning in Graphics for Design. In preparation for sketching, learners could experiment with plasticine models to see what size and shape would be best for the toothbrush. Their sketches and overall sizes can then be used to design the 3D model and orthographic drawings. A toothbrush holder may then be modelled, tested and improved. The final design may then be used to develop a promotional display.

### **Advice on distribution of time**

The distribution of time between the various Units is a matter for professional judgement and is entirely at the discretion of the centre. Each Unit is likely to require an approximately equal time allocation, although this may depend on the learners' prior learning in the different skill areas.

### **Resources**

Centres may find that existing equipment within either Design and Technology or Physics areas provide all that is required to deliver the Course. This equipment is summarised below:

- ◆ **Craft workshops** complete with suitable benches
- ◆ **Hand tools** and light machine tools
- ◆ **Drawing equipment** to allow production of 2D and 3D drawings and rendering
- ◆ **Internet-enabled computers** and a digital projector
- ◆ **Software** which can support the production of 3D models and promotional graphics.
- ◆ **Modelling kits** to construct mechanisms: currently available products include fishertechnik and Lego Technik, but others may be suitable; models may also be constructed from simple materials, such as straws, paper, wire etc
- ◆ **Simulation software**; currently available software includes Crocodile/Yenka Technology, Mechanisms or Resistant Materials (from Focus Educational Software Ltd) and West Point Bridge Designer, but many others, including apps, open source and freeware products may also be suitable
- ◆ **Access to websites**; for example, car manufacturers and other design-related companies which provide diagrams and sketches that may provide ideas to support projects

## **Developing skills for learning, skills for life and skills for work**

Guidance on the development of skills for life, skills for learning and skills for work is to be found in the support notes for each of the Units of the Course.

# Approaches to assessment

See the *Unit Support Notes* for guidance on approaches to assessment of the Units of the Course.

## Combining assessment across Units

If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units. For example, a mini-project (see 'Sequence of delivery', examples 2 and 3) may provide evidence for the Graphics for Design and either (or both) of the Designing and Modelling or Constructing and Testing Units.

# Equality and inclusion

The requirement to develop practical skills involving the use of equipment and tools may present challenges for learners with physical or visual impairment. In such cases, reasonable adjustments may be appropriate, including (for example) the use of adapted equipment or alternative assistive technologies.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Course Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Course.

It is important that centres are aware of and understand SQA's assessment arrangements for disabled learners, and those with additional support needs, when making requests for adjustments to published assessment arrangements. Centres will find more guidance on this in the series of publications on assessment arrangements on SQA's website: [www.sqa.org.uk/sqa/14977.html](http://www.sqa.org.uk/sqa/14977.html).

# Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- ◆ Assessment Arrangements (for disabled candidates and/or those with additional support needs) — various publications are available on SQA's website at: [www.sqa.org.uk/sqa/14977.html](http://www.sqa.org.uk/sqa/14977.html).
- ◆ [\*Building the Curriculum 4: Skills for learning, skills for life and skills for work\*](#)
- ◆ [\*Building the Curriculum 5: A framework for assessment\*](#)
- ◆ [\*Course Specifications\*](#)
- ◆ [\*Design Principles for National Courses\*](#)
- ◆ [\*Guide to Assessment\* \(June 2008\)](#)
- ◆ [\*Overview of Qualification Reports\*](#)
- ◆ Principles and practice papers for curriculum areas
- ◆ [\*SCQF Handbook: User Guide\*](#) (published 2009) and SCQF level descriptors (to be reviewed during 2011 to 2012): [www.sqa.org.uk/sqa/4595.html](http://www.sqa.org.uk/sqa/4595.html)
- ◆ [\*SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work\*](#)
- ◆ [\*Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool\*](#)

# Administrative information

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**Published:** July 2013 (version 1.1)

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## History of changes to Course Support Notes

Course details	Version	Description of change	Authorised by	Date
	1.1	Minor changes to notes on assessment of Outcomes.	Qualifications Development Manager	July 2013

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Note: You are advised to check SQA's website ([www.sqa.org.uk](http://www.sqa.org.uk)) to ensure you are using the most up-to-date version.

## Unit Support Notes — Graphics for Design (National 3)



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Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

# Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Graphics for Design (National 3) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- ◆ the *Unit Specification*
- ◆ the *Course Specification*
- ◆ the *Course Support Notes*
- ◆ appropriate assessment support materials

# General guidance on the Unit

## Aims

The general aim of this Unit, as stated in the *Unit Specification*, is to develop skills in producing and interpreting drawings, sketches and diagrams to support the design process. Learners will use computer-aided and/or manual graphic communication tools and techniques.

This Unit will also give learners the opportunity to develop thinking skills and skills in numeracy, employability, enterprise and citizenship.

The Unit can be delivered:

- ◆ as a stand-alone Unit
- ◆ as part of the National 3 Design and Technology Course

## Progression into this Unit

Entry to this Unit is at the discretion of the centre.

However, learners would normally be expected to have attained some useful skills and knowledge from prior learning within their broad general education.

Learners may also have gained relevant skills and knowledge through other education systems or from their own interests and informal learning.

## Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 3 Design and Technology *Course Support Notes*.

Teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

## Progression from this Unit

On successful completion of this unit, the following Units and Courses provide appropriate progression pathways for learners:

- ◆ Designing and Modelling (National 3) Unit
- ◆ Constructing and Testing (National 3) Unit
- ◆ National 4 Graphic Communication Course
- ◆ Skills for Work Courses in Energy and in Engineering Skills

# Approaches to learning, teaching and assessment

The Unit is designed to provide flexibility and choice for both the learner and the teacher.

Learning and teaching activities should be designed to stimulate learners' interest, and to develop skills and knowledge to the standard required by the Outcomes and to the level defined by the associated assessment standards.

Tasks and activities throughout the unit should be linked to relevant contexts. The Unit and Course Specifications define the skills and knowledge required, but leave complete freedom to the teacher or learner to select interesting contexts in which to develop these. Individual, paired or group problem-solving tasks should be related to real-life contexts, such as furniture, home ware, renewable energy technology or devices to assist individuals with disabilities. Learners may bring their own contexts to the Unit such as designing for people with arthritis, which might lead to the design of items such as pens, trays or kitchen utensils. Alternatively, something as simple as a free standing photo frame or a tea light holder, can lend itself well to developing the skills required for this Unit.

The National 3 Design and Technology *Course Support Notes* provide further broad guidance on approaches to learning and teaching which may apply to all the component Units of the course, and should be read before delivering this Unit.

## **Sequence of delivery of Outcomes**

The sequence of delivery of the Outcomes and the distribution of time between the Outcomes is a matter for professional judgement and is entirely at the discretion of the centre. Two main approaches are suggested, but other possibilities exist.

It is important to ensure adequate time for learning activities designed to develop learners' skills and knowledge before asking learners to produce evidence that they have achieved the required standards.

## **Delivering Outcomes 1 and 2 sequentially**

The obvious approach is to start with Outcome 1 and then progress to Outcome 2. Following this approach, learners could explore a range of sketching and rendering techniques to gain an understanding of how these can be applied to common design practices.

Learners may make use of 3D computer aided design and draughting software to develop design ideas. Orthographic drawings can be produced directly from the 3D model, or using 2D drawing methods. Drawings produced in Outcome 1 may then be used within the single-page display for Outcome 2. Where possible, compatibility of file types should be considered.

## **Alternative — delivering Outcomes 1 and 2 independently**

If the Outcomes are delivered independently (ie not using the drawings produced in Outcome 1 as material to be included in the promotional display for Outcome 2), then the Outcomes may be delivered in either order. This may suit learners who are concentrating on this unit only as a stand-alone piece of learning.

### **Thematic approach to Outcomes 1 and 2**

A thematic approach may be useful to make the learning more relevant. For example, the Unit could be delivered around the context of 'Fairtrade' with the learner asked to design a table centre or leaflet dispenser for Fairtrade fliers. This context would require learners to research and investigate colour, texture, fonts and layout of existing displays and make informed decisions on their design choices. The learner could use current Fairtrade material to reflect on the presentation, colour choice and fonts which are used in advertising material.

### **Delivering the Unit within the Design and Technology Course**

When delivering this Unit as part of the National 3 Design and Technology Course, Outcome 1 may be used to develop initial design ideas to be modelled or constructed in either or both of the other two Units. Outcome 2 may then be used to develop promotional material based on the products developed in the other two Units.

### **Meeting the needs of all learners**

There is no directly equivalent Unit at National 4 or National 2 level. However, the Unit may be used as a fall-back option for learners in a National 4 Graphic Communication class, who do not achieve the standards required for that Course.

### **Useful resources**

Although not a definitive list, the following resources may support the delivery of Graphics for Design:

- ◆ desks with drawing equipment
- ◆ rendering equipment — pastels, markers, bleed-proof paper, highlighting pencils, fine-liners, rulers, cutting knives, cutting boards, etc
- ◆ lightbox
- ◆ 3D computer aided design and draughting software
- ◆ illustration software
- ◆ internet-enabled computers and a digital projector
- ◆ visualisers and screen capture software

### **Approaches to delivering and assessing each Outcome**

The learner must demonstrate attainment of **all** of the Outcomes and their associated assessment standards. Assessment must be valid, reliable and fit for purpose.

SQA does not specify the methods of assessment to be used; teachers should determine the most appropriate method for their learners. In many cases, evidence (which may be oral or observational) will be gathered during normal classroom activities, rather than through formal assessment instruments.

Centres are expected to maintain a detailed record of evidence, including oral or observational evidence. Evidence in written or presentation format should be retained by the centre.

Assessment Evidence may be produced in a variety of formats including presentations, web pages, digital photographs, digital video, podcasts and blogs, and these can be stored by the learner (or teacher) within a proprietary e-portfolio, or simply by storing them in a secure folder.

## **Authentication of evidence**

All evidence should be gathered under supervised conditions.

In order to ensure that the learner's work is their own, the following strategies are recommended:

- ◆ personal interviews with learners where teachers can ask additional questions about the completed work
- ◆ asking learners to do an oral presentation on their work
- ◆ ensuring learners are clear about acknowledging sources
- ◆ using checklists to record the authentication activity

## **Outcome 1**

The learner will:

### **1 Produce, with guidance, graphical representations of simple design ideas by:**

- 1.1 Producing a well-proportioned sketch of a simple design idea, showing main dimensions
- 1.2 Choosing and applying colour to a sketch or drawing to convey texture and highlight
- 1.3 Using software to produce a rendered 3D model of a design idea
- 1.4 Producing orthographic drawings of a design idea

### **Notes on delivery of Outcome 1**

It is expected that the learners will develop their skills by producing a range of drawings, sketches and 3D models. While exemplars and structured tasks may be used to develop skills, centres are encouraged to do so within suitable contexts related to the design process, and to give opportunities for the application of skills and knowledge in creative ways. This may be best achieved if learners are encouraged to plan their graphical work, given opportunities to generate design ideas and innovate using previous artefacts related to their context. Using different methods of idea generation such as 'SAMs' or theme based influence will help develop creativity. The production of orthographic drawings may be achieved directly from a 3D computer model. Learners are not required to develop extensive skills in orthographic drawing for this Unit. The final drawings produced may then be used within the Designing and Modelling Unit.

### **Notes on assessment of Outcome 1**

Learners may build up a portfolio of naturally-occurring evidence covering the 4 assessment standards. It is expected that learners will develop a range of sketches and drawing as part of their learning, but evidence is only required of one successful example for each assessment standard.

- ◆ Evidence of standards 1.1, 1.2 and 1.4 may be produced by manual or electronic methods.
- ◆ For standard 1.4, a minimum of 3 views (plan, elevation and end elevation) would be expected.
- ◆ Evidence of standard 1.3 may be hard copy print outs or a saved file of the computer model.

## **Outcome 2**

The learner will:

### **2 Design and produce, with guidance, a single-page promotional display by:**

- 2.1 Making basic design decisions about layout, colours and fonts
- 2.2 Including a range of drawings and sketches to illustrate the design idea
- 2.3 Using text appropriately to provide relevant information
- 2.4 Combining graphics and text into a single-page display with visual impact

#### **Notes on delivery of Outcome 2**

The Outcome may be delivered in the context of a design process, incorporating sketches and drawing produced for Outcome 1. As a result, learners will experience the links between the design sketching phase and the computer generation phase and see the need to plan their working prior to development. The basics of font choice and colours should be discussed to develop good practice in aesthetics in promotional graphics. It may be beneficial to consider exemplar material to show good practice in promotional graphics with an emphasis on the use of fonts, colours and layout to achieve impact. The production of a single-page promotional display may be achieved in different ways and should reflect the centre and the learner's needs; however discussion around the alternative methods of generation may benefit the learners' progress in future study at other levels.

#### **Notes on assessment of Outcome 2**

All standards may be addressed using a single problem solving task or by a series of separate activities. Learners may build up a portfolio of naturally-occurring evidence covering the 4 assessment standards. It is expected that learners will develop a range of promotional displays as part of their learning, but evidence is only required of one successful example for each assessment standard.

- ◆ Evidence of standard 2.1 should include a basic plan for the display, with the learner explaining design decisions to the teacher or to peers.
- ◆ Evidence of standards 2.2, 2.3 and 2.4 will be the finished promotional display (which may be electronic or manually assembled).

## **Combining assessment within the Unit**

It may be possible to develop learning/assessment activities which provide evidence that learners have achieved the standards for more than one Outcome within the Unit, thereby reducing the assessment burden on learners. Combining assessment of Outcomes (or parts of Outcomes) in this way is perfectly acceptable, but needs to be carefully managed to ensure that all assessment standards and Outcomes for the Unit are covered.

# Developing skills for learning, skills for life and skills for work

Learners are expected to develop broad generic skills as an integral part of their learning experience. The *Unit Specification* lists the skills for learning, skills for life and skills for work that learners should develop through this Course. These are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and must be built into the Unit where there are appropriate opportunities. The level of these skills will be appropriate to the level of the Unit.

The table below highlights opportunities to develop these skills within this Unit.

<b>2 Numeracy</b>	
2.1 Money, time and measurement	Measurement/estimation of paper sizes and orientation Measurements related to layout guides Familiarisation with units of measurement
<b>4 Employability, enterprise and citizenship</b>	
4.2 Information and communication technology (ICT)	Using 3D computer aided design and draughting packages Using illustration software Researching design exemplars using online resources Making informed judgements on information obtained using technology
<b>5 Thinking skills</b>	
5.2 Understanding	Interpreting size and shape to produce an orthographic drawing Interpreting and using colour, font, texture, highlight in the production of a single-page display Developing understanding of different types of software packages and the use and operation of basic tools and commands
5.3 Applying	Applying skills knowledge and understanding to show, presentation (visual impact), texture and highlight, layout, colour and fonts, and combine text and graphics Show planning for the work to be carried out Organise tools/equipment to be used to carry out a task

The Unit may also provide opportunities to develop or consolidate other skills for life, learning and work, including:

- ◆ reading and writing
- ◆ working with others
- ◆ enterprise and citizenship
- ◆ evaluating

# Equality and inclusion

The requirement to develop practical skills involving the use of equipment and tools may present challenges for learners with physical or visual impairment. In such cases, reasonable adjustments may be appropriate, including (for example) the use of adapted equipment or alternative assistive technologies.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these Unit Support Notes is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and that the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

# Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- ◆ Assessment Arrangements (for disabled candidates and/or those with additional support needs) — various publications on SQA’s website: <http://www.sqa.org.uk/sqa/14976.html>
- ◆ [\*Building the Curriculum 4: Skills for learning, skills for life and skills for work\*](#)
- ◆ [\*Building the Curriculum 5: A framework for assessment\*](#)
- ◆ [Course Specifications](#)
- ◆ [Design Principles for National Courses](#)
- ◆ [Guide to Assessment \(June 2008\)](#)
- ◆ [Overview of Qualification Reports](#)
- ◆ *Principles and practice papers for curriculum areas*
- ◆ *Research Report 4 — Less is More: Good Practice in Reducing Assessment Time*
- ◆ *Coursework Authenticity — a Guide for Teachers and Lecturers*
- ◆ [SCQF Handbook: User Guide](#) (published 2009) and SCQF level descriptors (to be reviewed during 2011 to 2012): [www.sqa.org.uk/sqa/4595.html](http://www.sqa.org.uk/sqa/4595.html)
- ◆ [\*SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work\*](#)
- ◆ [\*Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool\*](#)
- ◆ SQA Guidelines on e-assessment for Schools
- ◆ SQA Guidelines on Online Assessment for Further Education
- ◆ SQA e-assessment web page: [www.sqa.org.uk/sqa/5606.html](http://www.sqa.org.uk/sqa/5606.html)

# Administrative information

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**Published:** July 2013 (version 1.1)

**Superclass:** CE

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## History of changes to Unit Support Notes

Unit details	Version	Description of change	Authorised by	Date
	1.1	Minor changes to notes on assessment of Outcomes.	Qualifications Development Manager	July 2013

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Note: You are advised to check SQA's website ([www.sqa.org.uk](http://www.sqa.org.uk)) to ensure you are using the most up-to-date version.

## Unit Support Notes — Designing and Modelling (National 3)



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Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

# Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Designing and Modelling (National 3) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- ◆ the *Unit Specification*
- ◆ the *Course Specification*
- ◆ the *Course Support Notes*
- ◆ appropriate assessment support materials

# General guidance on the Unit

## Aims

The general aim of this Unit, as stated in the *Unit Specification*, is for learners to follow, with guidance, a simple design process. They will make a simple physical model from design drawings, and refine the design based on simple evaluation of the model. Through these activities, learners will develop awareness of sustainability and recycling. Learners will also learn and apply safe working practices in a workshop, or similar, environment.

This Unit will also give learners the opportunity to develop thinking skills and skills in numeracy, employability, enterprise and citizenship.

The Unit can be delivered:

- ◆ as a stand-alone Unit
- ◆ as part of the National 3 Design and Technology Course

## Progression into this Unit

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained some useful skills and knowledge from prior learning within their broad general education.

Learners may also have gained relevant skills and knowledge through other education systems or from their own interests and informal learning.

## Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 3 Design and Technology *Course Support Notes*.

Teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

## Progression from this Unit

On successful completion of this unit, the following Units and Courses provide appropriate progression pathways for learners:

- ◆ Constructing and Testing (National 3) Unit
- ◆ National 4 Design and Manufacture Course
- ◆ Skills for Work Courses in Energy and in Engineering Skills

# Approaches to learning, teaching and assessment

The Unit is designed to provide flexibility and choice for both the learner and the teacher.

Learning and teaching activities should be designed to stimulate learners' interest, and to develop skills and knowledge to the standard required by the Outcomes and to the level defined by the associated assessment standards.

Tasks and activities throughout the Unit should be linked to relevant contexts. The Unit and Course Specifications define the skills and knowledge required, but leave complete freedom to the teacher or learner to select interesting contexts in which to develop these. Individual, paired or group design tasks should be related to real-life contexts such as furniture, home ware, renewable energy technology or devices for individuals with disabilities.

The National 3 Design and Technology *Course Support Notes* provide further broad guidance on approaches to learning and teaching which apply to all of the component Units of the Course, and should be read before delivering this Unit.

## **Sequence of delivery of Outcomes**

The sequence of delivery of the Outcomes and the distribution of time between the Outcomes is a matter for professional judgement and is entirely at the discretion of the centre. Possible approaches are suggested, but other possibilities exist.

It is important to ensure adequate time for learning activities designed to develop learners' skills and knowledge before asking learners to produce evidence that they have achieved the required standards.

## **Delivering Outcomes 1 and 2 sequentially**

The obvious approach is to start with Outcome 1 and then progress to Outcome 2, with Outcome 2 being based on the model developed in Outcome 1. The order in which the Outcomes are set is a natural and appropriate order for delivery and reflects common design practices.

However, the process of design is an iterative one, so that it may be better to think of the Outcomes as concurrent. Learners may model, then amend, then re-model, and repeat this several times.

An alternative approach could be for learners to complete Outcome 1 but then use a pre-built model for Outcome 2. This could offer greater chance of success for the less able learners and also prevent token amendments where there are no significant changes required to the learner's model.

## **Delivering the Unit within the Design and Technology Course**

When delivering this Unit as part of the National 3 Design and Technology Course, the modelling may be based on sketches and drawings developed from a design idea in the Graphics for Design Unit.

**Meeting the needs of all learners**

There is no directly equivalent Unit at National 4 or National 2 level. However, the Unit may be used as a fall-back option for learners in a National 4 Design and Manufacture class, who do not achieve the standards required for that Course.

**Useful resources**

Although not a definitive list, the following resources may support the delivery of the Unit:

- ◆ craft workshop complete with suitable workbenches
- ◆ suitable tools for the chosen modelling material(s)
- ◆ modelling materials (eg card, Styrofoam, wood, plasticine)
- ◆ equipment for sketching (computers with suitable software, or manual drawing equipment)
- ◆ internet-enabled computers and a digital projector

# Approaches to delivering and assessing each Outcome

The learner must demonstrate attainment of **all** of the Outcomes and their associated assessment standards. Assessment must be valid, reliable and fit for purpose.

SQA does not specify the methods of assessment to be used; teachers should determine the most appropriate method for their learners. In many cases, evidence (which may be oral or observational) will be gathered during normal classroom activities, rather than through formal assessment instruments.

Centres are expected to maintain a detailed record of evidence, including oral or observational evidence. Evidence in written or presentation format should be retained by the centre.

## Authentication of evidence

All evidence should be gathered under supervised conditions.

In order to ensure that the learner's work is their own, the following strategies are recommended:

- ◆ personal interviews with learners where teachers can ask additional questions about the completed work
- ◆ asking learners to do an oral presentation on their work
- ◆ ensuring learners are clear about acknowledging sources
- ◆ using checklists to record the authentication activity

Assessment evidence may be produced in a variety of formats including presentations, web pages, digital photographs, digital video, podcasts and blogs, and these can be stored by the learner (or teacher) within a proprietary e-portfolio, or simply by storing them in a secure folder.

## Outcome 1

The learner will:

### 1 **Make, with guidance, a simple physical model from design drawings and sketches by:**

- 1.1 Extracting dimensions from given drawings
- 1.2 Selecting suitable materials, giving consideration to issues of sustainability
- 1.3 Selecting and using appropriate tools and equipment
- 1.4 Applying safe working practices

### Notes on delivery of Outcome 1

The learner may work from drawings provided by the teacher, or from drawings produced during the Graphics for Design Unit. Whichever source is used, the learner must interpret the drawings and transfer dimensions from the drawing onto material. Appropriate guidance may be provided. Learners should be given opportunities to develop understanding of materials and tools selection, so that they can make suitable choices when making their model(s).

Learners should be given the opportunity to develop a clear understanding of safety in the workplace, including awareness towards others around them and good practice in tool use, transportation and storage. These safe working practices should be applied at all times.

### **Notes on assessment of Outcome 1**

It is expected that learners will develop a range of physical models, using a variety of materials, such as card, Styrofoam, plastics or wood, as part of their learning, but only one model is required for evidence of achieving the assessment standards.

Evidence of the Outcome should be a finished model (or photographic evidence of this) which corresponds with reasonable accuracy with the drawings used, supplemented by:

- ◆ observational evidence of the application of safe working practice, and
- ◆ oral evidence of standards 1.2, 1.3 and 1.4, with the learner explaining selection decisions to the teacher or to peers

### **Outcome 2**

The learner will:

#### **2 Amend a design based on simple evaluation of a model by:**

- 2.1 Assessing the effectiveness of the model against given design criteria
- 2.2 Identifying improvements which could be made to the design
- 2.3 Producing sketches to communicate an amended design

### **Notes on delivery of Outcome 2**

Outcome 2 may be integrated with Outcome 1 through a project-based learning approach. However, better understanding of an iterative design process may be developed where the evaluation is based on an exemplar model which has significant design flaws. This will develop the learners' skill in evaluating. Sketches can be of any format and must communicate clearly the modified ideas. Annotated views may help the process of communication and support the learner in developing their communication skill.

Where possible, the learner should be given the opportunity to implement amendments to the model they developed for Outcome 1, although this is not an assessment requirement for this Outcome.

### **Notes on assessment of Outcome 2**

Evidence covering the three assessment standards is likely to be produced naturally during the teaching and learning process.

- ◆ Evidence of standard 2.1 may be oral, with the learner explaining to the teacher (or to peers).
- ◆ Evidence of standards 2.2 and 2.3 is most likely to be in the form of annotated drawings.

## Combining assessment within Units

It may be possible to develop learning/assessment activities which provide evidence that learners have achieved the standards for more than one Outcome within the Unit, thereby reducing the assessment burden on learners. Combining assessment of Outcomes (or parts of Outcomes) in this way is perfectly acceptable, but needs to be carefully managed to ensure that all assessment standards and Outcomes for the Unit are covered.

## Developing skills for learning, skills for life and skills for work

Learners are expected to develop broad generic skills as an integral part of their learning experience. The *Unit Specification* lists the skills for learning, skills for life and skills for work that learners should develop through this Course. These are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and must be built into the Unit where there are appropriate opportunities. The level of these skills will be appropriate to the level of the Unit.

The table below highlights opportunities to develop these skills during this Unit.

<b>2 Numeracy</b>	
2.1 Money, time and measurement	Measurement of material to an appropriate degree of accuracy Familiarisation with units of measurement
<b>4 Employability, enterprise and citizenship</b>	
4.2 Information and communication technology (ICT)	Researching materials using online resources Making informed judgements on information obtained using technology Ability to use the internet safely
<b>5 Thinking skills</b>	
5.2 Understanding	Interpreting and using drawings to make/manufacture a model Developing an understanding of different types of materials and the use and operation of basic hand and machine tools
5.3 Applying	Applying safe working practices at all times Show planning for the work to be carried out Organise tools to be used to carry out a task Applying appropriate skills, knowledge and understanding of materials, tools and processes related to craft work to solve a problem and make a model to suit.

The Unit may also provide opportunities to develop or consolidate other skills for life, learning and work, including:

- ◆ reading and writing
- ◆ working with others
- ◆ enterprise and citizenship
- ◆ evaluating

# Equality and inclusion

The requirement to develop practical skills involving the use of equipment and tools may present challenges for learners with physical or visual impairment. In such cases, reasonable adjustments may be appropriate, including (for example) the use of adapted equipment or alternative assistive technologies.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these Unit Support Notes is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and that the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

# Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- ◆ Assessment Arrangements (for disabled candidates and/or those with additional support needs) — various publications on SQA’s website: <http://www.sqa.org.uk/sqa/14976.html>
- ◆ [\*Building the Curriculum 4: Skills for learning, skills for life and skills for work\*](#)
- ◆ [\*Building the Curriculum 5: A framework for assessment\*](#)
- ◆ [Course Specifications](#)
- ◆ [Design Principles for National Courses](#)
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- ◆ *Research Report 4 — Less is More: Good Practice in Reducing Assessment Time*
- ◆ *Coursework Authenticity — a Guide for Teachers and Lecturers*
- ◆ [SCQF Handbook: User Guide](#) (published 2009) and SCQF level descriptors (to be reviewed during 2011 to 2012): [www.sqa.org.uk/sqa/4595.html](http://www.sqa.org.uk/sqa/4595.html)
- ◆ [\*SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work\*](#)
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- ◆ SQA Guidelines on e-assessment for Schools
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# Administrative information

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## History of changes to Unit Support Notes

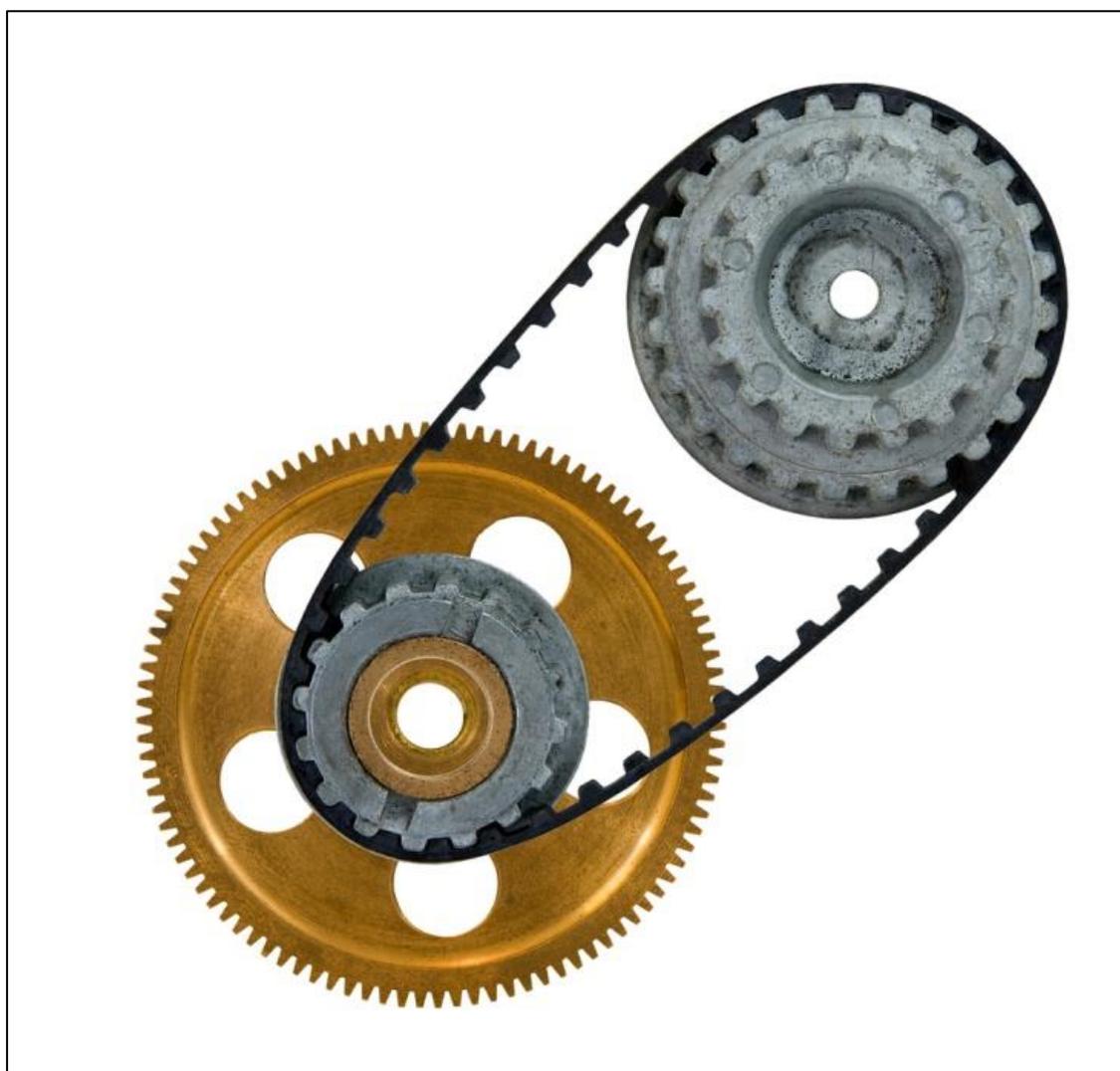
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## Unit Support Notes — Constructing and Testing (National 3)



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Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

# Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Constructing and Testing (National 3) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- ◆ the *Unit Specification*
- ◆ the *Course Specification*
- ◆ the *Course Support Notes*
- ◆ appropriate assessment support materials

# General guidance on the Unit

## Aims

The general aim of this Unit, as stated in the *Unit Specification*, is for learners to develop an understanding of structures and mechanisms by solving simple engineering problems. They will construct (or simulate) and test simple solutions demonstrating strengthening, energy transfer and/or movement. Learners will draw conclusions based on the test results. Learners will also develop and apply safe working practices in a workshop, or similar, environment.

This Unit will also give learners the opportunity to develop thinking skills and as skills in numeracy, employability, enterprise and citizenship.

The Unit can be delivered:

- ◆ as a stand-alone Unit
- ◆ as part of the National 3 Design and Technology Course

## Progression into this Unit

Entry to this Unit is at the discretion of the centre.

However, learners would normally be expected to have attained some useful skills and knowledge from prior learning within their broad general education.

Learners may also have gained relevant skills and knowledge through other education systems or from their own interests and informal learning.

## Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 3 Design and Technology *Course Support Notes*.

Teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

## Progression from this Unit

On successful completion of this Unit, the following Courses provide appropriate progression pathways for learners:

- ◆ National 4 Engineering Science
- ◆ National 4 Practical Electronics
- ◆ Skills for Work Courses in Energy and in Engineering Skills

# Approaches to learning, teaching and assessment

The Unit is designed to provide flexibility and choice for both the learner and the teacher.

Learning and teaching activities should be designed to stimulate learners' interest, and to develop skills and knowledge to the standard required by the Outcomes and to the level defined by the associated assessment standards.

Tasks and activities throughout the unit should be linked to relevant contexts. The Unit and Course Specifications define the skills and knowledge required, but leave complete freedom to the teacher or learner to select interesting contexts in which to develop these. Individual, paired or group problem-solving tasks should be related to contexts such as furniture design, cycle design, bridge design, mechanical toys or play park rides. Aspects of existing designed and engineered solutions and real-world problems can be studied to aid understanding.

The National 3 Design and Technology *Course Support Notes* provide further broad guidance on approaches to learning and teaching which apply to all the component Units of the Course, and should be read before delivering this Unit.

It is important to ensure adequate time for learning activities designed to develop learners' skills and knowledge before asking learners to produce evidence that they have achieved the required standards.

When delivering this Unit as part of the National 3 Design and Technology Course, the activities and learning within this Unit may be integrated with the other two Units.

For example, a particular context could be chosen, and used as follows:

- ◆ sketches and drawings of a design idea could be developed for Outcome 1 of the Graphics for Design Unit
- ◆ the design idea could be modelled and re-modelled for the Designing and Modelling Unit
- ◆ moving or electronic parts could be designed, constructed and tested for the Constructing and Testing Unit
- ◆ a promotional display could be produced for Outcome 2 of the Graphics for Design Unit

## Meeting the needs of all learners

There is no directly equivalent Unit at National 4 or National 2 level. However, the Unit may be used as a fall-back option for learners in a National 4 Engineering Science class, who do not achieve the standards required for that Course.

### **Useful resources**

Although not a definitive list, the following resources may support the delivery of this Unit:

- ◆ internet-enabled computers and a digital projector
- ◆ exemplar models of interesting mechanisms and structures
- ◆ modelling kits to construct mechanisms: currently available products include fishertechnik and Lego Technik, but others may be suitable
- ◆ simulation software: currently available software includes Crocodile/Yenka Technology, Mechanisms or Resistant Materials (from Focus Educational Software Ltd) and West Point Bridge Designer, but many others, including apps, open source and freeware products may also be suitable
- ◆ variety of materials — hardwood, softwoods, man-made boards, thermoplastics, thermosetting plastics, ferrous metals and non-ferrous metals

# Approaches to delivering and assessing the Outcome

Note: there is only one Outcome for this Unit.

The learner must demonstrate attainment of **all** of the assessment standards. Assessment must be valid, reliable and fit for purpose.

SQA does not specify the methods of assessment to be used; teachers should determine the most appropriate method for their learners. In many cases, evidence (which may be oral or observational) may be gathered during normal classroom activities, rather than through formal assessment instruments. Centres are expected to maintain a detailed record of evidence, including oral or observational evidence. Evidence in written or presentation format should be retained by the centre.

## Authentication of evidence

All evidence should be gathered under supervised conditions.

In order to ensure that the learner's work is their own, the following strategies are recommended:

- ◆ personal interviews with learners where teachers can ask additional questions about the completed work
- ◆ asking learners to do an oral presentation on their work
- ◆ ensuring learners are clear about acknowledging sources
- ◆ using checklists to record the authentication activity

Assessment evidence may be produced in a variety of formats including presentations, web pages, digital photographs, digital video, podcasts and blogs, and these can be stored by the learner (or teacher) within a proprietary e-portfolio, or simply by storing them in a secure folder.

## Outcome 1

The learner will:

### 1 Construct and test simple engineered objects involving strengthening, energy transfer or movement by:

- 1.1 Selecting, with guidance, components and/or suitable materials
- 1.2 Applying basic engineering knowledge of mechanisms and structures
- 1.3 Devising, with guidance, appropriate methods of testing
- 1.4 Recording the results of testing
- 1.5 Drawing conclusions from the test results

### Notes on delivery of Outcome 1

The learners should be given tasks which require them to develop and apply basic knowledge and understanding of mechanisms and structures by selecting appropriate components and/or material for a specific engineered object.

Learners should be given the opportunities to test the objects they have constructed. For example, if bridge building is the context for learning, the learner may test different sectional areas of material and/or different materials to determine their suitability for tensile or compressive components in the design. The learner would be expected to make judgement on the characteristics of the materials and cross-sectional areas of materials based on their findings.

**Notes on assessment of Outcome 1**

Learners may build up a portfolio of naturally-occurring evidence covering the 4 assessment standards. It is expected that learners will construct and test a range of engineered objects as part of their learning, but evidence is only required of one successful example for each assessment standard.

Evidence of all standards should be the finished engineered object (or photographic evidence of this) supplemented by:

- ◆ oral or observational evidence of standards 1.1, 1.2 and 1.3 with the learner explaining decisions to the teacher or to peers
- ◆ written or oral evidence of testing and conclusions for standards 1.4 and 1.5

Where possible, the learner should be given the opportunity to adapt or improve their engineered object based on the results and conclusions of their testing, although this is not an assessment requirement for this Unit.

## Developing skills for learning, skills for life and skills for work

Learners are expected to develop broad generic skills as an integral part of their learning experience. The *Unit Specification* lists the skills for learning, skills for life and skills for work that learners should develop through this Course. These are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and must be built into the Unit where there are appropriate opportunities. The level of these skills will be appropriate to the level of the Unit.

The table below highlights opportunities to develop these skills during this Unit.

<b>2 Numeracy</b>	
2.1 Money, time and measurement	Material section size (area) and shape Familiarisation with units of measurement
<b>4 Employability, enterprise and citizenship</b>	
4.2 Information and communication technology (ICT)	Making informed judgements on information obtained using technology Ability to use the internet safely Using simulation packages Researching materials/strengthening using online resources

<b>5 Thinking skills</b>	
5.2 Understanding	Interpreting and using methods of testing Developing understanding of different types and characteristics of materials and the use of these in different design situations
5.3 Applying	Applying knowledge and understanding of findings to designing Applying tests to gauge an understanding of the characteristics of materials/components

The Unit may also provide opportunities to develop or consolidate other skills for life, learning and work, including:

- ◆ reading and writing
- ◆ working with others
- ◆ enterprise and citizenship
- ◆ evaluating

# Equality and inclusion

The requirement to develop practical skills involving the use of equipment and tools may present challenges for learners with physical or visual impairment. In such cases, reasonable adjustments may be appropriate, including (for example) the use of adapted equipment or alternative assistive technologies.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these Unit Support Notes is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and that the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

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