

## National 5 Design and Manufacture 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 5 Design and Manufacture 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*, the *Course Assessment 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 the design and manufacturing of models, prototypes and products
- ◆ knowledge and understanding of manufacturing processes and materials
- ◆ an understanding of the impact of design and manufacturing technologies on our environment and society

Underpinning these aims are the activities which support them — creative and iterative thinking, problem solving, understanding the relationship between cause and effect of decisions taken, an engagement with a variety of technologies in both design and manufacture, dialogue and discussion, and the articulation, communication and realisation of ideas.

## Progression into this Course

Entry into this Course is at the discretion of the centre however learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- ◆ National 4 Design and Manufacture Course

### Other experience

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

### Experiences and Outcomes

Learners who have completed relevant Curriculum for Excellence experiences and outcomes will find these an appropriate basis for doing the Course.

## 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.

Note: teachers and lecturers should refer to the *Course Assessment Specification* for mandatory information about the skills, knowledge and understanding to be covered in this Course.

Skills, knowledge and understanding may be developed throughout the Course. The table below shows where there are likely to be opportunities to develop skills, knowledge and understanding in or across the Units. This however, in no way suggests that these skills, knowledge and understanding can be covered in totality in any singular Unit. The delivery model adopted and the approaches to learning and teaching will determine how and where the opportunities actually arise.

Skills	Knowledge and understanding	Design	Materials and Manufacture	Added value
Researching	Research techniques	✓		
Analysing information	Evaluation techniques, specifications	✓		
Idea generation	Idea generation techniques	✓		✓
Applying knowledge of design factors	Design factors	✓		✓
Applying graphic techniques	Graphic techniques	✓		✓
Applying modelling techniques	Modelling techniques	✓		✓
Applying knowledge of tools materials and processes	Tools, materials and processes	✓	✓	✓
Applying planning techniques	Planning techniques	✓	✓	✓
Apply manufacturing techniques	Manufacturing techniques, health and safety		✓	✓
	Commercial manufacture		✓	
	The impact of design technologies on the society and the environment	✓	✓	

\* No single Unit on its own is likely to meet the required standard. An integrated approach may however assist in capturing evidence.

## Progression from this Course

This Course or its components may provide progression to:

- ◆ Higher Design and Manufacture Course
- ◆ other technological Courses at Higher

and, ultimately, for some, to:

- ◆ employment, apprenticeships and/or training in design and/or manufacturing related fields
- ◆ Higher and Advanced Higher Design and Manufacture Courses

## Hierarchies

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

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.

This Course is designed in hierarchy with the corresponding Courses at SCQF levels 4 and 6 (National 4 and Higher) and has the same structure of three Units with corresponding titles.

Each of the two Units — *Design, Materials and Manufacturing* — is in hierarchy with the corresponding Unit at SCQF levels 4 and 6. The design of the Units means that teachers with a multi-level class may be able to design learning activities that are appropriate for a group of learners working at different levels.

Teachers should also refer to the Outcomes and Assessment Standards for each level when planning delivery. A table is provided in Appendix 2, which demonstrates the comparison between the Design and Manufacture National 5 and Higher Courses.

Further advice on multi-level delivery is given in the National 5 Design and Manufacture *Unit Support Notes*.

# Approaches to learning and teaching

The Course is dynamic, ‘hands on’ and ‘brains on’. It is intended to be delivered through the fullest range of teaching and learning strategies in order that all learners can engage with what will be interesting, exploratory, and experiential learning activities. Teachers and lecturers should ensure that as much of the learning as possible is active learning.

The Course consists of two Units — *Design*, and *Materials and Manufacturing* — and a Course assessment — (assignment and question paper). The order in which Units are taught is not prescribed and it is for the centre to decide which will best support the learners in achieving their goals. Whatever approach is taken should not jeopardise the aims, intentions and essence of the Course. Professional knowledge of the learners and their needs may dictate specific avenues of approach, and careful planning partnered with strategic delivery will ensure that the learning experience will be as rich as possible.

Unit Specifications indicate a range of factors, materials and processes which are familiar and common to most centres in the contexts of design and manufacturing. However, centres should not limit themselves to those processes or materials alone, if others are available. Where centres have specific experience, expertise, equipment, materials and resources for additional or contemporary processes, then they are encouraged to make effective use of these to enhance and enrich the learners’ experiences. Where centres do not possess, or have access to, examples of the latest manufacturing technology, then the use of multimedia and web-based resources, or local business partnerships might be effectively employed to demonstrate the operation and application of these technologies.

Close attention to issues of sustainability is encouraged, as is the potential to use alternative or reused materials in lieu of those from a raw source. Learners should be encouraged to consider the six ‘R’s: ‘rethink, reuse, recycle, repair, reduce, and refuse’ and a circular economy, cradle-to-cradle design approach, when making designing and manufacturing decisions.

## **Sequence of delivery**

While there is no prescribed delivery sequence, centres should make considered judgement as to which sequence will best support the needs of their learners. There are several approaches to the delivery of the Course; as an integration of the two Units, as discrete Units or as a hybrid approach.

### *Integrated Unit delivery*

This approach would involve the centre structuring its course around a series of ‘design and make’ activities. These activities would require centres to provide learners with the opportunity to acquire the mandatory skills, knowledge and understanding of the Course.

This main benefit of this approach is that it provides a more natural context for the learning and teaching, ie learners are making items which they have designed and designing items which they will make. It is likely that learners will be able to observe and relate to the implicit and explicit connections between the

knowledge and experiences of the two Units and more importantly different activities.

This approach requires careful planning to not only ensure that all mandatory skills, knowledge and understanding is covered, but also that suitable assessment evidence is generated.

*Discrete Unit delivery*

It is possible to deliver both Units discretely, ie Design followed by Materials and Manufacturing or vice versa. It would also be possible to deliver discrete Units by alternating activities, ie short activity focused on design, followed by short activity focused on materials and manufacturing and then repeated.

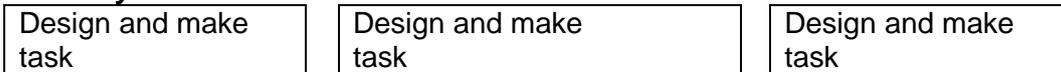
Discrete Unit delivery may be an option when room/resource availability is restrictive.

*Hybrid Unit delivery*

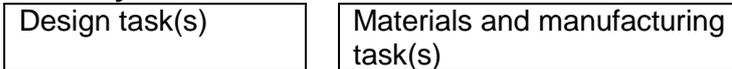
This approach is a combination of the two other approaches. It involves structuring delivery around a combination of integrated activities and discrete activities, eg a 'design and make' task followed by a practical task to build skills in a particular area. This approach would allow application of knowledge and skills across the whole design process, but may also ease room/resource restrictions.

A summary of the approaches is shown below:

**Integrated Unit delivery**



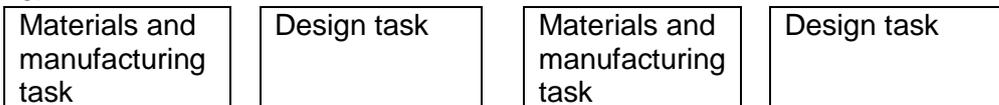
**Discrete Unit delivery**



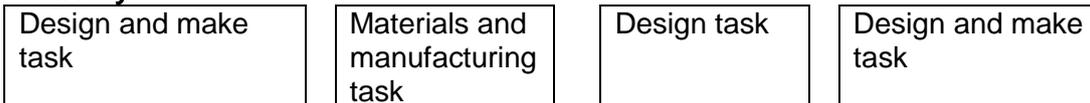
or



or



**Hybrid Unit delivery**



Note that the number of tasks for all approaches is at the centre's discretion.

Whichever order or combination is chosen, the centre must ensure that the learner is experiencing, exploring and engaging in both design and practical activities.

Teaching and learning should be balanced and contextualised. Contexts for design and manufacturing activities are to be found throughout Scotland, and where practicable, local expertise and contributions should be employed to invigorate learning.

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

The needs and interests of the learners and the expertise within the centre will largely determine the allocation of time for each of the activities and experiences, and hence the overall Unit duration. Each Unit carries equal credit points. As it is likely that centres will adopt an integrated approach, the specific time allocation per Unit is less of a concern, as long as the balance of activities is appropriate to the Course and that the needs of the learners are met in achieving the standards required.

Within the time allocated for the Design and Manufacture assignment, learning and teaching time will be required for:

- ◆ preparation for the assignment, which could include considering exemplar assignments and practising the application and integration of skills
- ◆ carrying out all the stages of the assignment, with teacher guidance and support

### **Connecting the learning**

Practitioners should either make or help learners make the connections between what is 'being' learned technologically, and what is and has been learned generally. There are clear connections between technological knowledge and technological activity and other disciplines: the expressive arts, and mathematical and scientific knowledge and activities. Active, engaging technological learning provides a natural vehicle for building confidence in language, writing, argument, and interpretative and analytical skills. In addition, good technological activity lends itself to visiting and considering the close relationships between the social, geographical and historical dimensions of the activity as well as contemporary influences and effects. Opportunities should be taken to raise learners' awareness of these connections.

Historically and culturally, Scotland is a rich source of technological learning and development, and it forms a considerable and rich part of its heritage. Scotland's technological dimension has made outstanding contributions to global technological activity. This heritage together with both the Scottish and European dimensions might be a feature of the learning. 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.

### **Extending the learning: personalisation and choice**

The scope of the tasks should be presented in a way which allows learners to connect with, and personalise the activity. This, however, should not be beyond the ability of the learner or the knowledge and confidence of the practitioner. Situations or scenarios which are relevant and meaningful to the individual or their community are likely to be engaging and enjoyable.

## **Assessment**

Effective strategies for learning and teaching should be designed to support the Assessment Standards required from each Unit. These Assessment Standards can be found within each *Unit Specification*.

It is logical that the Course assessment should only be undertaken if learners are ready and prepared for the activity. Furthermore, centres should ensure that whatever model it adopts, the requirements of the Course are met.

Assessment activities, used to support learning, may usefully be blended with learning activities throughout the Course. The principles of assessment for the purposes of learning should be employed throughout learners' experiences on this Course. The Course and its component Units provide ample opportunity to utilise these principles. The use of feedback and 'self and peer critique' regarding design ideas, concepts, solutions and practical activity will be invaluable to the learner's progress and understanding of the issues that will need to be resolved, within the contexts of design and manufacture. Centres should ensure that, where peer feedback is being used, it is practicably and theoretically correct. This may be achieved through follow-up discussions or exploring the feedback responses in greater depth with individuals, groups or the class. Learners may often present an opinion as a preconception or a misconception — this however can be a springboard for further experiment or activities in testing those opinions. It is often more beneficial for the learners to 'arrive' at the correct destination by themselves.

The use of appropriate assessment strategies will, in addition, support learning by:

- ◆ sharing learning intentions/success criteria
- ◆ using assessment information as a basis for directing learners to improve performance, and adapting teaching and learning activities appropriately
- ◆ boosting learners' confidence by providing supportive feedback

Pedagogy for Design and Technology leaves ample opportunity for learners and teachers to make effective and active use of ICT in learning, teaching and assessment activities. Using IT for feedback, commentaries or critiques may support effective learning and self and peer assessment activities. Using ICT in design can bring an added dimension to learning in this subject area.

Assessment evidence may be generated 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.

Centres may wish to draw up their own guidance on how technology and ICT might be best used to support and record learners' progress in the Unit Outcomes, or indeed as it can present a picture of the learners' journeys.

## **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 component Units.

# Approaches to assessment

Additional information on Unit assessment approaches is given within each of the Unit Specifications.

The pace of Design and Manufacture is fast, and it is imperative that centres keep close track of evidence trails for assessment purposes and ensure that rigour is not overtaken by the pace. Learners should be encouraged to maintain clear, tidy folios which are supported by thoughts and notes where needed. However, rough sketches, sketch models and ideas inform us about learners' thinking and justify why decisions have been taken. These are very important and should not be unduly discarded, as they will inform both the learner and the practitioner. This evidence will assist centres in determining exactly how the learner has arrived at their decisions, proposals, choices, approaches, methods and solutions. It is not necessary that each folio is a presentation piece in its entirety; the crucial evidence is to support thinking and learning.

Centres may design their own methods for recording this evidence — it might be in note form or logs, digital records, e.g. audio-visual, photographic, spreadsheets, conversations, dialogue, discussion, and of course the physical evidence itself or a system unique to the learner. The evidence must however be valid and prove that the learner's achievements are accurate and valid.

The design of the Units should make the gathering of evidence a natural activity. There will however be key points at which the centre will wish to focus on obtaining specific evidence as it contributes to the learner's progress.

There are a variety of approaches to assessment:

- ◆ a combined approach whereby tasks are set which can cover Assessment Standards across both the *Design*, and the *Materials and Manufacturing* Units (although some discrete Unit activities may be necessary)
- ◆ a Unit-by-Unit approach whereby tasks are set which cover only the Assessment Standards for either the *Design*, or the *Materials and Manufacturing* Units
- ◆ a portfolio approach, where collection of naturally occurring evidence is used to support the achievement of Assessment Standards — this could be gathered from structured tasks, discrete activities, themed work, etc
- ◆ a combination of approaches — assessors may mix and match according to the needs of their learners

In each case, evidence should be judged in the same way and by using the information given on making assessment judgements in SQA documentation for Unit Assessment Support contained on the secure website.

## Added value

Courses from National 4 to Advanced Higher include assessment of added value. At National 5, Higher and Advanced Higher, the added value will be assessed in the Course assessment.

Information given in the *Course Specification* and the *Course Assessment Specification* (Courses at National 5 and above) about the assessment of added value is mandatory.

## **Preparation for Course assessment**

Each Course has additional time which may be used at the discretion of the teacher or lecturer to enable learners to prepare for Course assessment. This time may be used near the start of the Course and at various points throughout the Course for consolidation and support. It may also be used for preparation for Unit assessment, and towards the end of the Course, for further integration, revision and preparation and/or gathering evidence for Course assessment.

Information given in the *Course Specification* and the *Course Assessment Specification* about the assessment of added value is mandatory.

Centres are free to consider how they will prepare learners to undertake the Course assessment to ensure that they will be as successful as possible. Although this will vary between centres, it is likely that learners will also have opportunities presented throughout the Unit activities to consolidate and prepare. That aside, for the Course assessment, time will be required for:

- ◆ preparation for the assignment, which could include considering exemplar assignments and practising the application and integration of skills
- ◆ carrying out the stages of the assignment, with teacher guidance and support
- ◆ assessing the process and completed solution
- ◆ consolidation of learning
- ◆ development of problem solving skills
- ◆ preparation for the question paper

## **Combining assessment across Units**

If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units.

Centres are free to combine evidence across Units in order to meet the standard. Centres should plan their approaches to assessment logically and look for key points to gather supporting evidence at naturally occurring points in learning.

Centres may also find the combination of assessments across Units beneficial to a learner's development as this supports the links in learning between the Units of work in Design and Manufacture. This structure may also maximise the time for teaching and learning and avoiding the potential for repetition. Parts of or whole Outcomes or Units may be partnered with other Units and assessed where appropriate.

# Equality and inclusion

Within any design and manufacturing-styled course there are specific activities with which individual learners may experience particular challenges; there may also be specific issues with equipment. In such cases reasonable adjustments may be appropriate, for example:

- ◆ specific learners could be supported, where required, under the direction of the learner, provided this does not affect the integrity of the qualification
- ◆ adaptive or assistive technologies should be explored as a means to facilitating greater independence
- ◆ using jigs or alternative techniques to assist with three-dimensional physical modelling

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 learners 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 \(June 2008\)](#)
- ◆ 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\*](#)
- ◆ <http://www.ellenmacarthurfoundation.org/>

## Appendix 2: Higher and National 5 comparison

(This should be read in conjunction with the Course Assessment Specifications.)

Topic area		National 5 Design and Manufacture: Design	Higher Design and Manufacture: Design	
<b>Members of a design team</b>		Designers, market researchers, accountants, engineers, manufacturers, marketing teams, ergonomists, consumers, retailers, economists.	<b>Members of a design team</b>	Designers, market researchers, accountants, engineers, manufacturers, lawyers, materials technologists, production specialists, marketing teams, ergonomists, consumers, retailers, economists, sub-contractor. Relationships between team members and types of teams.
<b>Design process</b>	<b>Identification of a problem</b>	Situation analysis need and wants product evaluation.		
	<b>Brief</b>	Statement of problem, target market, design brief analysis.	<b>Brief</b>	Purpose, statement of problem, target market. Open brief, closed brief. Design brief analysis.
	<b>Research</b>	Such as use of search engines, measuring and recording, asking questions, surveys, using data.	<b>Research</b>	Sources of recorded and non-recorded information, methods of gathering information. Analysis, application and presentation of researched material.

	<b>Specification</b>	Generation of a specification.	<b>Specification</b>	Types and purpose of specifications: brief, product design specification, performance specification, marketing specification and technical specification. Application of researched material to produce a product design specification.
	<b>Idea generation</b>	Morphological analysis, thought showers, technology transfer, analogy, and lateral thinking. Application of idea generation techniques. Mood and lifestyle boards.		
	<b>Development and refinement of ideas</b>	Synthesis of ideas. Justification and recording of decisions taken. Presentation and modelling techniques.		
	<b>Evaluation</b>	Surveys, user trials, comparisons with specifications and standards, the concept of function and fitness for purpose.	<b>Evaluation</b>	Surveys, questionnaires, user trips/trials, observation, testing, test rigs, comparison to other products, and comparison to specification. Application of evaluation techniques, presentation of results.

<b>Design factors</b>	<b>Function</b>	Primary and secondary functions, fitness for purpose.		
	<b>Performance</b>	Ease of maintenance, strength and durability, ease of use, material selection, construction, size.	<b>Performance</b>	Design for reuse, for recycling, planned obsolescence, value for money, ease of maintenance, environmental aspects.
	<b>Market</b>	Consumer demands, social expectations, niche marketing, branding, introduction of new products, market segments, marketing mix, needs, wants, technology push, market pull.		
	<b>Aesthetics</b>	Shape, proportion, size, colour, contrast, harmony, texture, materials, fashion.	<b>Aesthetics</b>	Factors influencing aesthetics (shape, line, form, colour, proportion, contrast, pattern, light, texture, harmony, balance), influences of fashion, market trends, style.
	<b>Ergonomics</b>	Establishing critical sizes, basic understanding of how humans interact with products, anthropometrics.	<b>Ergonomics</b>	Anthropometrics, psychology, physiology.

<b>Communication and modelling techniques</b>	<b>Graphic techniques</b>	Working drawings, annotated sketches and drawings, perspective sketches, illustration and presentation techniques, scale and proportion, simple orthographic drawings.	<b>Graphic techniques</b>	The use and role of graphic techniques in communicating design ideas, information and detail effectively, eg annotated sketches, orthographic drawings, isometric, oblique, one point and two point perspective, exploded views, dimensioned views, illustration techniques, CAD, use of scale. Use of graphic techniques to develop, communicate and resolve ideas.
	<b>Range of modelling techniques and materials</b>	The role of simple modelling as it supports designing — scale models, mock-ups, fully crafted prototypes, computer generated models.	<b>Range of modelling techniques and materials</b>	The use and role of modelling as it supports designing: scale models, mock-ups, fully crafted prototypes, test models, computer generated models, part product models, simulations, rapid prototyping.
		Use of appropriate modelling materials such as paper, card, corrugated card, MDF, wire, pipe cleaners, foam, clay, modelling compound, balsa wood, expanded foam, sheet plastic, construction kits, smart materials.		
<b>The impact of design technologies on the society and the environment</b>		Rise of consumerism, affordable and accessible products, impact of design decisions.		

Topic area		National 5 Design and Manufacture: Materials and Manufacturing	Higher Design and Manufacture: Materials and Manufacturing	
<b>Planning for manufacture</b>		Preparing materials, planning for practical tasks, assembly, selecting appropriate tooling and finishes, reading of working drawings and diagrams, including an appreciation of orthographic projection.	<b>Production and planning systems</b>	One-off, batch, mass, line, flow. Gantt charts, flow charts, project planning, JIT, jigs, patterns, standardised components, CAD/CAM and CNC.
<b>Tools, materials and processes</b>	<b>Knowledge and understanding of common tools and equipment</b>	<p>A range of common an acceptable tools or equipment for: holding, clamping and restraining materials.</p> <p>A range of common an acceptable machine tools for: sanding, shaping, drilling or other similar activities.</p>	Assumed prior learning skills and knowledge. Where a learner is undertaking the Course from areas of study other than National 5 Design and Manufacture, these skills and knowledge may have to be overtaken as new learning.	
	<b>Fixing and joining techniques</b>	A range of standard and recognised jointing/joining techniques for woods, metals and plastics including thermal joining and adhesive bonding.	Assumed prior learning skills and knowledge. Where a learner is undertaking the Course from areas of study other than National 5 Design and Manufacture, these skills and knowledge may have to be overtaken as new learning.	

		<b>Plastics</b>	Polythene (high and low density), polyvinyl chloride, polystyrene, nylon, cellulose acetate, acrylic, polypropylene, ABS, epoxy resin, melamine formaldehyde, urea formaldehyde, polyester resin, glass-reinforced plastic, carbon-fibre plastics, elastomers including, where appropriate, labelling and symbols.
		<b>Metals</b>	Mild steel, carbon steel, stainless steel, high-speed steel, cast iron, brass, bronze, aluminium and aluminium alloys, copper, tin, lead, zinc.
		<b>Woods</b>	Beech, oak, ash, mahogany, teak, walnut, balsa, Scots pine, red cedar, Parana pine, spruce.
		<b>Timber derivatives</b>	Manufactured boards (fibreboards, plywood, block-board, chipboard, hard board), veneer.
	<b>Metalworking and associated processes</b>	Cutting, shearing, notching, parallel and step turning, taper turning, drilling, knurling, annealing, hardening, tempering, filing, folding, bending, fitting and fixing, and in industry — casting, die-casting.	<b>Metal processes</b>

	<b>Woodworking and associated processes</b>	Cutting, sizing, drilling, shaping, turning.	<b>Wood processes</b>	Cutting, drilling, turning, routing, laminating, spindle moulding, CNC, adhesive bonding, finishing.
	<b>Plastic work</b>	Cutting, drilling, filing, forming, bending and twisting, moulding and in industry, rotational moulding.	<b>Plastic processes</b>	Cutting, injection-moulding, extrusion, rotational moulding, vacuum-forming, blow-moulding, laminating, joining, compression moulding, calendering, casting, bending, fabrication, coating, forming, adhesive bonding, finishing.
	<b>Surface finishing</b>	Sanding/abrading, polishing, varnishing, oiling, staining, waxing, painting/lacquering, dip coating.	Assumed prior learning skills and knowledge. Where a learner is undertaking the Course from areas of study other than National 5 Design and Manufacture, these skills and knowledge may have to be overtaken as new learning.	
<b>Manufacturing in industry</b>		Computer-aided manufacture- benefits: (unit cost for mass production, quality assurance, globalisation, clean manufacturing);	<b>(Production and planning systems)</b>	See 'Production and planning systems' above.

	drawbacks: (breakdown, set up cost), awareness of rapid prototyping technology Identification of common industrial processes, standard components.	<b>Identification of commercial processes</b>	Form, material, split lines, injection points, ejector points, shrinkage, draft angle, intricate form, clean and precise, flash, thinning of sheet material, shear marks, cross-section over length, surface texture.
<b>The properties of common materials</b>	Softwoods, hardwoods, manufactured boards, ferrous and non-ferrous metals, thermoplastics and thermosetting plastics.	<b>Properties of materials</b>	Justification of the selection of materials based on their properties in the design, manufacturing and use of products.
<b>The impact of manufacturing technologies and activities on the world of work and society</b>	Reduction in workforce, skilled workforce, cost of equipment, impact on environment (energy and pollution) and the measures that can be taken to support sustainability.	Energy efficiency, materials innovation, design for recyclability, design for reuse, employment patterns, consumer choices, new skill sets, skill changes.	
<b>Health and safety</b>	Safe working practices and systems applicable to manufacturing activities, workshops or environments.		

# Administrative information

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**Published:** May 2015 (version 2.0)

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## History of changes to Course Support Notes

Version	Description of change	Authorised by	Date
1.1	Minor changes to assessment information, 'cradle-to-cradle' defined.	Qualifications Development Manager	June 2013
2.0	All Outcomes and Assessment Standards completely revised.	Qualifications Manager	May 2015

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## Unit Support Notes — Design and Manufacture: Design (National 5)



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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 *Design and Manufacture: Design* (National 5) 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 Assessment Specification*
- ◆ the *Course Support Notes*
- ◆ appropriate assessment support materials

# General guidance on the Unit

## Aims

The general aim of this Unit is to develop the learner's skills and creativity in designing a product towards manufacturing. Learners will develop skills in analysing a design brief and developing a solution to a final concept by generating ideas and applying knowledge of design factors, materials and manufacturing, graphic techniques and modelling techniques. The focus will be on maintaining a practical approach to designing, allowing learners to develop their knowledge, skills and capability.

The Unit is also designed to enable the learner to develop an understanding of the impact of design and manufacturing technologies on our environment and society.

By undertaking this Unit, learners will develop a variety of skills in communication through the production of design folios. Learners will develop skills in listening and talking as they discuss design problems with others.

Numeracy skills will be developed and drawn on as learners make informed use of measurement, anthropometric data, results recorded from testing, and the properties and characteristics of materials and manufacturing processes.

The development of thinking skills is an essential element of the learning in this Unit, and learners will progress, build on and justify the design decisions they make.

Learners will apply their developing skills and knowledge in problem solving activities in response to realistic and relevant situations.

This Unit can be delivered

- ◆ as a stand-alone Unit
- ◆ as a component of the National 5 Design and Manufacture Course

This Unit is a mandatory Unit of the National 5 Design and Manufacture Course.

## Progression into this Unit

Entry into this Unit is at the discretion of the centre however learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- ◆ National 4 Design and Manufacture Course
- ◆ Design and Manufacture Unit: Design (National 4) Unit

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

Centres should satisfy themselves that learner's prior learning will support the likelihood of success.

## Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 5 Design and Manufacture *Course Support Notes*.

If the Unit is being delivered as part of the National 5 Design and Manufacture Course, the teacher should refer to the 'Further mandatory information on Course coverage' section within the *Course Assessment Specification* for detailed content.

If this Unit is being delivered on a free-standing basis, 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 may provide appropriate progression pathways for learners:

- ◆ Design and Manufacture: Design (Higher) Unit
- ◆ other technological Courses at Higher

This Unit may support a learner's access to further education or employment as part of a wider entrance portfolio.

Centres should take account of the learner's strengths and the appropriateness of this Unit for entry to other Courses or programmes of study.

# Approaches to learning and teaching

Centres should ensure teaching and learning strategies provide access for all learners to this Unit. The effective and strategic use of resources including ICT, a differentiated approach, learning aids and adapted resources where appropriate might be considered in providing an inclusive learning environment.

Advances in technology have introduced options that can extend access and opportunity as well as personalisation and choice to all learners. Encouraging personalisation and choice is a recurring theme for qualifications developed to support the Curriculum for Excellence.

Teachers and lecturers are encouraged to use different approaches to learning and teaching to support the needs of all learners.

Some approaches to learning and teaching are given below but are suggestions only. Teachers and lecturers are encouraged to develop and plan their own strategies appropriate to the needs and strengths of learners in their centres.

- ◆ Personal investigation and research
- ◆ Audio/visual presentations
- ◆ External visits/field trips
- ◆ Guest speakers
- ◆ Demonstration of practical tasks
- ◆ Outdoor learning
- ◆ Active learning
- ◆ Co-operative and collaborative learning
- ◆ Peer education
- ◆ Use of ICT
- ◆ Project-based
- ◆ Effective use of out-of-school learning activities

Support materials and resources can be found by visiting Education Scotland's website — 'Learning, teaching and assessment approaches'.

## Sequence of Outcomes

There is no prescribed order in which centres must deliver the Unit Outcomes.

There are two Outcomes in this Unit.

- 1 Analyse a design brief and produce a detailed specification
- 2 Explore and refine ideas to produce a design proposal

Learners should have gained the skills, knowledge and understanding associated with the Outcomes before undertaking the assessment activity.

The skills, knowledge and understanding likely to be required for each Outcome are given in the following table:

Outcome	Skills	Knowledge and understanding
1 Analyse a design brief and produce a detailed specification	<ul style="list-style-type: none"> <li>◆ Researching</li> <li>◆ Analysing</li> </ul>	<ul style="list-style-type: none"> <li>◆ Design factors</li> <li>◆ Research techniques</li> <li>◆ Specifications</li> </ul>
2 Explore and refine ideas to produce a design proposal	<ul style="list-style-type: none"> <li>◆ Idea generation</li> <li>◆ Applying knowledge of design factors</li> <li>◆ Applying modelling techniques</li> <li>◆ Applying graphic techniques</li> </ul>	<ul style="list-style-type: none"> <li>◆ Idea generation techniques</li> <li>◆ Modelling techniques</li> <li>◆ Graphic techniques</li> </ul>

Centres may approach development of the skills, knowledge and understanding in the form of 'mini projects' that focus on developing in context.

Assessment evidence may be generated by one activity which covers the two Outcomes, a discrete activity to cover each Outcome or several activities which cover Assessment Standards across the Outcomes.

Where a centre approaches learning and teaching in a set of project-based activities, then evidence of the learner's best work for each Outcome may be obtained from a variety of practical design tasks.

Whatever approach is adopted, centres must satisfy themselves that the planned delivery best supports their own needs and in particular those of their learners. More information is given in the *Course Support Notes* to assist in strategies for cross-Unit planning.

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

The National 5 Design and Manufacture Course is designed to be hierarchical. This should support multi-level teaching where required. It is likely that most centres will be familiar with strategies for multi-level approaches in Design and Manufacture styled Courses such as: Intermediate Courses for Product Design or Standard Grade Craft and Design already, and be able to draw upon this good practice.

Many of the skill sets between National 5 and National 4 are similar, with National 5 generally requiring greater independence on the part of the learner, increased breadth, depth and study in techniques and knowledge.

In each of the Outcomes there are some key differences in the expectations of learners between National 5 and National 4. These key differences can be found in the detail of the *Unit Specifications* for both National 5 and National 4.

In each of the Outcomes it is likely that common activities with opportunities for enrichment and development will support learners in meeting the required standards of the working levels. Such differentiation would include materials, study resources, time planning and independent learning tasks.

It is also likely that set and similar themes or contexts will support learners undertaking National 4 and National 5 in the same class. Centres are discouraged from repeating the same theme or context where a learner is likely to progress from National 4 to National 5 in subsequent academic sessions to avoid the potential for repetition. This might suggest biannual themes.

## 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 Unit. 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>	
2.2 Money, time and measurement	◆ Measurement, dimension
<b>4 Employability, enterprise and citizenship</b>	
4.4 Enterprise	◆ Working creatively to resolve design problems, co-operative working
<b>5 Thinking skills</b>	
5.2 Understanding	◆ Techniques and their application, impact of design activities
5.3 Applying	◆ Design knowledge and skills to simple problems in determining possible solutions
5.4 Analysing and evaluating	◆ Evaluating the impact of design

# Approaches to assessment and gathering evidence

## Outcome 1

The learner will:

### 1 Analyse a design brief and produce a detailed specification by:

- 1.1 Researching design factors using a range of techniques
- 1.2 Incorporating research findings into a detailed specification

#### Notes on Outcome 1

The brief may be given to the learners or they may generate their own. It is very important that the brief contains enough information to allow them to generate appropriate evidence for the two Assessment Standards. A very vague or open brief is likely to leave the learner carrying out invalid research, resulting in a poor specification.

Learners should select enough design factors to allow them to fully analyse the brief and produce a specification which details the requirements of the proposal.

Research carried out should be aimed at producing a detailed specification and not be generic. Learners should be given direction when their research is misguided.

The research evidence may be presented in a number of ways; though it is most likely it will appear in a portfolio of work which includes text, photographs, charts and graphs. The specification is likely to be in the form of a list of the requirements of each of the design factors researched.

## Outcome 2

The learner will:

### 2 Explore and refine ideas to produce a design proposal by:

- 2.1 Applying knowledge of design factors effectively
- 2.2 Evaluating and justifying of design decisions effectively
- 2.3 Applying idea generation techniques effectively
- 2.4 Applying 2D and 3D graphic techniques effectively
- 2.5 Applying modelling techniques effectively

#### Notes on Outcome 2

The starting point for this Outcome may be the specification generated from Outcome 1 or may be another specification supplied by the centre. It is very important that the specification provides enough detail to allow the learners to explore and refine ideas. A vague specification will make it more difficult for learners to display the skills required to meet the Assessment Standards of this Outcome.

Learners may demonstrate the use of ideas generation techniques throughout the production of the proposal.

It is expected that learners will use a broad range of modelling techniques and graphic techniques during the exploration and refinement of the proposal. Techniques used should be appropriate to their purpose and may include computer generated graphics and models, where appropriate.

Learners should use their knowledge and understanding of design issues in the exploration and refinement of the proposal, and evaluate and justify decisions taken. Evidence of this may be in a variety of forms, including annotations and explanatory graphics.

## **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.

### **Unit assessment**

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 for verification.

### **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

Further information is given on the SQA secure website for Unit Assessment Support if assessing on a Unit-by-Unit basis.

# Equality and inclusion

The in-built flexibility of design methods both encourages learning through the entire range of graphic skills and allows the individual learner, for whom experience across the range of designing skills is not possible, to progress through the Unit using production methods best suited to the individual learner. ICT undoubtedly has an important role to play.

The choice in setting briefs specific to the learners' needs or to the local environment and local expertise can support learning through personalising the learning process. Careful choices of project or contexts for learning will undoubtedly assist in its accessibility to all learners.

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 approaches 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 learners 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 \(June 2008\)\*](#)
- ◆ *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)
- ◆ <http://www.ellenmacarthurfoundation.org/>

# Administrative information

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## History of changes to Unit Support Notes

Version	Description of change	Authorised by	Date
1.1	Minor changes to assessment information, 'cradle-to-cradle' defined.	Qualifications Development Manager	June 2013
2.0	All Outcomes and Assessment Standards completely revised.	Qualifications Manager	May 2015

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## Unit Support Notes — Design and Manufacture: Materials and Manufacturing (National 5)



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Please refer to the note of changes at the end of this template 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 *Design and Manufacture: Materials and Manufacturing* (National 5) 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 Assessment Specification*
- ◆ the *Course Support Notes*
- ◆ appropriate assessment support materials

# General guidance on the Unit

## Aims

The general aim of this Unit is to develop the learner's skills in planning, implementing and reviewing the manufacture of a product, model or prototype. The aim includes developing an appreciation and application of the properties and uses of materials, and an understanding of the key aspects of commercial manufacture.

Learners will manufacture models and/or prototypes, applying a range of practical skills. The Unit is designed to enable the learner to develop knowledge and grow in awareness of the impact and influence of materials and manufacturing on design activities and subsequently on the environment.

Throughout this Unit, learners will develop skills in technological capability and literacy through the development of knowledge and understanding and by practice in manipulating materials through common processes. Through discussion, dialogue, problem solving and reflective activities, learners will continue to develop their skills in listening and talking and the skills needed to work with others co-operatively.

Learners will utilise and build on their numeracy skills as they undertake activities involving measuring and marking, judging, gauging, counting, distributing and creating numerical or quantitative lists as they apply them to their project or product requirements.

Teachers and lecturers should create focused activities in which learners can demonstrate the ability to think and be creative, to problem solve, and use resources effectively in meeting a perceived need. By using relevant and realistic scenarios, learners will be able to apply these skills in context.

This Unit can be delivered

- ◆ as a stand-alone Unit
- ◆ as a component of the National 5 Design and Manufacture Course

This Unit is a mandatory Unit of the National 5 Design and Manufacture Course.

## Progression into this Unit

Entry into this Unit is at the discretion of the centre however learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- ◆ National 4 Design and Manufacture Course
- ◆ National 4 Design and Manufacture Unit: Materials and Manufacturing

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

Centres should satisfy themselves that learner's prior learning will support the likelihood of success.

## **Skills, knowledge and understanding covered in this Unit**

Information about skills, knowledge and understanding is given in the National 5 Design and Manufacture *Course Support Notes*.

If the Unit is being delivered as part of the Course, the teacher should refer to the 'Further mandatory information on Course coverage' section within the *Course Assessment Specification* for detailed content.

If this Unit is being delivered on a free-standing basis, 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 may provide appropriate progression pathways for learners:

- ◆ Design and Manufacture: Materials and Manufacturing (Higher)
- ◆ other technological Courses at Higher

This Unit may support a learner's access to further education or employment as part of a wider entrance portfolio.

Centres should take account of the learner's strengths and the appropriateness of this Unit for entry to other Courses or programmes of study.

# Approaches to learning and teaching

Centres should ensure teaching and learning strategies provide access for all learners to this Unit. The effective and strategic use of resources including ICT, a differentiated approach, learning aids and adapted resources where appropriate might be considered in providing an engaging and inclusive learning environment.

Advances in technology have introduced options that can extend access and opportunity as well as personalisation and choice to all learners. Encouraging personalisation and choice is a recurring theme for qualifications developed to support the Curriculum for Excellence.

Teachers and lecturers are encouraged to use different learning and teaching strategies to support the needs of all learners.

Some approaches to learning and teaching are given below but are suggestions only. Teachers and lecturers are encouraged to develop and plan their own strategies appropriate to the needs and strengths of learners in their centres.

- ◆ Personal investigation and research
- ◆ Audio/visual presentations
- ◆ External visits/field trips
- ◆ Guest speakers
- ◆ Demonstration of practical tasks
- ◆ Outdoor learning
- ◆ Active learning
- ◆ Co-operative and collaborative learning
- ◆ Peer education
- ◆ Use of ICT
- ◆ Project-based
- ◆ Effective use of out-of-school learning activities

Support materials and resources can be found by visiting Education Scotland's website — 'Learning, teaching and assessment approaches'.

## Sequence of Outcomes

There is no prescribed order in which centres must deliver the Unit Outcomes.

There are three Outcomes in this Unit.

- 1 Plan the manufacture of a prototype
- 2 Manufacture and review a prototype
- 3 Explain the key aspects of commercial manufacture

Learners should have gained the skills, knowledge and understanding associated with the Outcomes before undertaking the assessment activity.

The skills, knowledge and understanding likely to be required for each Outcome are given in the following table:

<b>Outcome</b>	<b>Skills</b>	<b>Knowledge and understanding</b>
1 Plan the manufacture of a prototype	<ul style="list-style-type: none"> <li>◆ Applying planning techniques</li> </ul>	<ul style="list-style-type: none"> <li>◆ Planning techniques</li> </ul>
2 Manufacture and review a prototype	<ul style="list-style-type: none"> <li>◆ Applying knowledge of tools, materials and processes</li> <li>◆ Apply manufacturing techniques</li> </ul>	<ul style="list-style-type: none"> <li>◆ Tools, materials and processes</li> <li>◆ Manufacturing techniques</li> <li>◆ Health and safety</li> </ul>
3 Explain the key aspects of commercial manufacture		<ul style="list-style-type: none"> <li>◆ Commercial manufacture</li> <li>◆ The impact of design technologies on the society and the environment</li> </ul>

Centres may approach development of the skills, knowledge and understanding in the form of 'mini projects'.

Assessment evidence may be generated by one activity which covers the three Outcomes, a discrete activity to cover each Outcome or several activities which cover Assessment Standards across the Outcomes.

Outcomes 1 and 2 have a natural link and centres may wish to devise tasks which allow learners to carry out planning activities before manufacturing a product. The product designed in Unit 1 may be suitable for such an activity. Evidence for Outcome 3 could be generated by a written task or may have been generated as part of the development for the product in Outcome 1. Evidence for Outcome 1 may also be generated as responses to a written task.

Centres should spend sufficient time developing practical skills in working with a variety of materials, tools and manufacturing techniques. This could be done in the form of 'mini projects' that focus on developing skills in context.

Centres should also commit sufficient time to developing knowledge and application of the breadth of common materials, tools and manufacturing processes applied in a workshop context.

Where a centre approaches learning and teaching in a set of project-based activities, then evidence of the learner's best work for each Outcome may be obtained from a variety of practical design tasks.

If centres use a project-based approach to learning and teaching, evidence of the learner's best work for each Outcome is likely to be captured from across a range of practical activities.

Whatever approach is adopted, centres must satisfy themselves that the planned delivery best supports their own needs and in particular those of their learners.

More information is given in the *Course Support Notes* to assist in strategies for cross-Unit planning — with particular reference to tasks.

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

The National 5 Design and Manufacture Course is designed to be hierarchical. This should support multi-level teaching where required. It is likely that most centres will be familiar with many strategies for multi-level approaches in Design and Manufacture styled Courses such as: Intermediate Courses for Product Design or Standard Grade Craft and Design already, and be able to draw upon this good practice.

Many of the skill sets between National 5 and National 4 are similar with National 4 generally requiring independent working and a higher level of skill in producing and creating artefacts, products, models with associated quality in finishing.

In each of the Outcomes there are some key differences in the expectations of learners between National 5 and National 4. These key differences can be found in the detail of the *Unit Specifications* for both National 5 and National 4.

In each of the Outcomes, it is likely that common activities with opportunities for enrichment and development will support learners in meeting the required standards of the working levels. Such differentiation would include materials, study resources, time planning and independent learning tasks.

It is also likely that set and similar themes or contexts will support learners undertaking National 4 and National 5 in the same class. Centres are discouraged from repeating the same theme or context where a learner is likely to progress from National 4 to National 5 in subsequent academic sessions to avoid the potential for repetition. This might suggest biannual themes.

## **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 Unit. 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>	
2.2 Money, time and measurement	◆ Measurement, dimension
<b>4 Employability, enterprise and citizenship</b>	
4.4 Enterprise	◆ Working creatively to resolve manufacturing problems, co-operative working
<b>5 Thinking skills</b>	
5.2 Understanding	◆ Techniques and their application, impact of manufacturing activities
5.3 Applying	◆ Materials and manufacturing knowledge and skills to manufacturing tasks and activities
5.4 Analysing and evaluating	◆ Evaluating the prototype ◆ Evaluating the impact of manufacturing and materials activities

# Approaches to assessment and gathering evidence

## Outcome 1

The learner will:

### 1 Plan the manufacture of a prototype by:

- 1.1 Selecting and justifying materials to suit manufacturing tasks
- 1.2 Selecting suitable tools and equipment for manufacturing tasks
- 1.3 Producing a detailed sequence of operations

### Notes on Outcome 1

The evidence for this Outcome may be naturally generated as part of a design folio for Unit 1 or be generated in response to a new task. Emphasis should be placed on logical approaches to manufacturing sequencing. Opportunities to predict the effect of incorrect sequencing should be taken to enhance the learner's thinking skills.

## Outcome 2

The learner will:

### 2 Manufacture and review a prototype by:

- 2.1 Preparing and marking materials for component parts
- 2.2 Cutting, shaping and finishing component parts
- 2.3 Assembling and joining component parts
- 2.4 Finishing assembled prototype
- 2.5 Testing the prototype

### Notes on Outcome 2

Evidence for this Outcome may be generated from one task or across a number of tasks. It is likely that guidance will be required in the correct selection of tools and equipment. These are opportunities to correct potential misconceptions about how tools are used correctly, as they may not necessarily be used that way in the learner's home. This will also support safe working practice. Testing the prototype may be done by using a range of evaluation techniques.

## Outcome 3

The learner will:

### 3 Explain the key aspects of commercial manufacture by:

- 3.1 Identifying and justifying suitable materials for commercial manufacture
- 3.2 Identifying and justifying suitable processes for commercial manufacture
- 3.3 Identifying ways in which design and manufacturing technologies impact on the environment and society

### Notes on Outcome 3

Evidence for this Outcome may be generated from extension of activity from Outcomes 1 and 2, as extension of design work from Unit 1 or as separate activity.

Learners should be made aware of what is expected of them. Success criteria should be shared and learners should be given access to exemplar material where appropriate in order to develop an understanding of the standard and quality expected of them. Learners should be given ample opportunity to practice and hone their practical skills before assessment takes place. This can be achieved in the form of smaller practical activities to allow learners the opportunity to work with a variety of materials, tools and processes to build experience and proficiencies before embarking on the assessed project.

Evidence may be a combination of written, oral, graphic and practical evidence. Evidence may be presented for individual Outcomes or it may be gathered for the Unit as a whole through combining assessment holistically in one single activity. If the latter approach is used, it must be clear how the evidence addresses the requirements and standards of the Outcomes. Centres should avoid the potential for over-assessment and duplication of assessment and look for naturally occurring evidence as it is revealed through learners' activities.

Learners should be encouraged to undertake 'self and peer evaluation' and seek feedback from a variety of sources. Feedback would normally be recorded although it need not be a formal or laborious process. Learners should work closely with the teacher or lecturer in identifying the most appropriate evidence of their attainment in each of the Outcomes.

Assessment can be combined from different Outcomes. Combining assessment will minimise repetition, allow more time for learning and allow centres to manage the assessment process more efficiently.

Where centres have obtained evidence across Outcomes, they must be able to clearly identify those parts in which the learner has not met the standard in order that those specific parts may be re-assessed without repeating the combined assessment. In developing learning and teaching materials and resources, centres will support the needs of their learners and their particular preferences.

Learners must demonstrate evidence of their performance in all Outcomes in the Unit in order to pass the Unit. They should be given time for re-assessment if necessary.

It is also useful to remember that there may be opportunities in the day-to-day delivery of the Outcomes in this Unit to observe learners providing evidence which satisfies, completely or partially, an Outcome or Standard. This is naturally occurring evidence and there is no reason why this evidence cannot be recorded as evidence for the Units or parts of Units. (In some cases, additional evidence may also be required to supplement and confirm the naturally occurring evidence.)

# 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.

## Unit assessment

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 for verification.

## 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

Further information is given on the SQA secure website for Unit Assessment Support if assessing on a Unit-by-Unit basis.

# Equality and inclusion

Where learners have accessibility needs then all efforts should be made to support and accommodate their learning and successes in the Course.

Learners should be allowed to make use of templates and jigs to assist them to complete the manufacturing task.

Full use should be made of ICT where appropriate to assist learners to develop skills in knowledge and understanding of materials and processes. Learners should be allowed to make use of word processing software and text-to-speech software if necessary. Learners should be given access to learning materials in electronic format, if necessary to their needs, so that it can be adapted to make it accessible.

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 learners 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 \(June 2008\)\*](#)
- ◆ *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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## History of changes to Unit Support Notes

Version	Description of change	Authorised by	Date
1.1	Minor changes to assessment information, 'cradle-to-cradle' defined.	Qualifications Development Manager	June 2013
2.0	Alterations made to reflect the changes to all Outcomes and Assessment Standards.	Qualifications Manager	May 2015

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