Unit 90: 3D Design Media, Techniques and Technology

Unit code: R/502/5262

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

● Aim and purpose

The aim of this unit is to encourage learners to develop the skills, understanding and knowledge of working with a range of 3D materials in order to fully realise the potential of their ideas.

● Unit introduction

Designers, makers and craftspeople explore three-dimensional (3D) ideas by manipulating a range of media and materials in responding to given or self-defined briefs. This unit enables learners to develop their understanding of 3D design and to practise using some of the materials, technology and techniques associated with 3D working. They will investigate the manipulation of different materials and appropriate making techniques. Learners may choose to explore a broad range of materials or to focus on a specialist area such as ceramics, product design, jewellery, interior or spatial design, or model making. Techniques and technologies involved with these activities may include hand tools and equipment, power tools and machinery, and the use of computers. They will learn how Computer Aided Design (CAD) can assist drafting and technical drawing of parts, products, structures, space and buildings.

Learners will learn about the health and safety issues associated with both the materials used and the techniques involved in manipulating them. The appropriate COSHH guidance should be followed at all times.

Learners will be able to identify the relevant characteristics and properties of various 3D materials. This may be through a series of samples and test pieces, annotated sketchbooks, or review and evaluation of finished objects. Learners will investigate the importance of the appropriate choice and use of materials and making techniques in the process of developing and realising 3D design ideas.

Learners will develop the ability to effectively evaluate their use of materials and processes. This evaluation may take the form of a written piece in a work journal or sketchbook entries. It may include working to a prescribed reflective practice model. Learners will demonstrate how evaluation and reflection underpins and informs visual drawings that clearly illustrate how the learner has moved through a series of materials or processes.

● Learning outcomes

On completion of this unit a learner should:

1 Know about the characteristics and properties of 3D materials

2 Be able to investigate 3D media, techniques and technology

3 Be able to use 3D media, techniques and technology safely

4 Understand own use of 3D media, techniques and technology.

Unit content

1 Know about the characteristics and properties of 3D materials

Investigate working with a range of materials: clay, eg earthenware, stoneware, porcelain, slip, oxides, stains, glazes; wood, eg manufactured boards, softwood, hardwood, balsa wood; metals, eg copper, brass, tin, zinc, aluminium, 'new' white metals, alloys, wax for modelling, lost-wax casting; plaster, eg modelling, mould making; plastics, eg perspex, acrylic, polymers, polyester resins, plastic sheet, modelmaking, prototypes, 3D printing; other materials, eg card, paper, string, acetate, soft wire, glues, adhesives, solvents

2 Be able to investigate 3D media, techniques and technology

Making techniques: ceramics, eg slab building, coiling, throwing, slip decoration and glazes; jewellery, eg soldering, polishing, setting, threading, twisting, enamelling, decorating; product design, eg cutting, sawing, sanding, carving, modelling, bending, vacuum forming, joining, finishing, painting, digital 3D techniques; architectural, eg spatial, forms, modelling, digital 3D

Processes: technology, eg hand tools, power tools, machinery, computers (3D modelling, Computer Aided Design (CAD)), orthographic projection, working drawings, storage, 3D representations, rendered images

3 Be able to use 3D media, materials and technology safely

Legislation that affects practice in the workshop and studio: Health and Safety at Work Act 1974; Control of Substances Hazardous to Health (COSHH) Regulations 1994; Personal Protective Equipment at Work Regulations 1992; Provision and Use of Work Equipment Regulations 1992

4 Understand own use of 3D media, techniques and technology

Use of 3D media, techniques and technology: analysis and reflection of experimentation with materials and processes, eg written pieces in a work journal, sketchbook entries, annotated visual entries, working to a prescribed reflective practice model; clearly illustrate working progress through a series of materials or processes

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 describe the characteristics and properties of 3D materials [IE, CT, RL, TW, SM, EP]	**M1** describe the characteristics and properties of diverse 3D materials	**D1** describe in detail with correct terminology the characteristics and properties of a comprehensive range of 3D materials
P2 investigate 3D media, techniques and technology [IE, CT, RL, TW, SM, EP]	**M2** effectively investigate a diverse range of 3D media, techniques and technology	**D2** independently investigate a comprehensive range of 3D media, techniques and technology
P3 use 3D media, techniques and technology safely [IE, CT, RL, TW, SM, EP]	**M3** coherently use a diverse range of 3D media, techniques and technology	**D3** innovatively use a comprehensive range of 3D media, techniques and technology
P4 discuss own use of 3D media, techniques and technology. [IE, CT, RL, TW, SM, EP]	**M4** analyse own use of 3D media, techniques and technology.	**D4** evaluate own use of 3D media, techniques and technology.

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key			
	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

This unit requires the learner to develop and demonstrate an understanding of working with 3D design media, techniques and technology.

In this unit, while there is a requirement to make appropriate reference to the work of other designers, the emphasis is on acquiring skills and understanding related to an area of practice (ceramics, product design, jewellery, interior or spatial design, model making, installations). These areas of practice can mostly be related to the materials categories (paper, card, clay, wood, metal, plastics) but some may include the use of less familiar materials for design making. The breadth of the learning programme should be flexible and allow learners to either pursue a general learning experience or to develop skills in a more focused way. Delivery should stimulate and motivate the learners to explore the creative possibilities of using materials and techniques.

Learners should be encouraged to undertake in-depth exploration and to extend their capability to develop confident manipulative skills and understanding. There are traditional skills associated with each discipline and these should be taught so as to provide a sound basis for self-directed study. Learners should also be encouraged to explore creative, unconventional uses of materials and techniques but it is essential that exploration be conducted on the basis of awareness of potential risk and with confidence in applying conventional skills. Learners should use hands-on material manipulation to inform understanding and design work produced using CAD software.

It is also important for learners to acquire the skills necessary to analyse, evaluate and discuss their own work and that of relevant professional practitioners. This will enable them to self-critically develop creative solutions to design briefs.

It is likely that the criteria for all four learning outcomes will be met from a series of briefs that allow learners to explore the nature of materials and use that exploration to develop responses to 3D design or craft briefs. The process should include recording all experiments and ideas as well as finished objects. Project scenarios should be realistic and, if simulated, should be set in an industrial context.

Learning outcomes 1 and 2 should be delivered primarily through practical studio and workshop experiences. Learners should have access to appropriate 3D media and equipment. Teaching should be stimulating, contextual and include innovative opportunities to explore the potential of materials and associated techniques to develop ideas. The delivery should also provide opportunities for learners to develop their understanding of historical and contemporary craft and design.

To understand the properties and characteristics of 3D materials, learners need to record their experimentation demonstrating influences on their use of materials, in the context and styling of the outcomes they produce. Working models, prototypes and maquettes, leading to a 3D outcome, will practically demonstrate the sophistication of those choices.

Learning outcome 3 delivery and learning works in tandem with learning outcomes 1 and 2, as developing skills in manipulating materials and safety awareness is integral to the process of experimentation and exploration. Health and safety considerations are a particularly important part of this unit and learners should be fully aware of their responsibilities within the studio and the major legislation that applies to their work. Evidence of this awareness may take the form of annotations, written responses, inclusion of safety notes or handouts in sketchbooks, worksheets or work journals, or evidence from verbal responses. Learner skills development can be demonstrated by a range of samples, experiments or finished objects that confirm a growing competence in the use of techniques and handling of materials. Learners' ability to use materials creatively and innovatively is likely to develop through specific skills acquisition and competences in using materials. Access to photographic resources, to record elemental stages, would be helpful but is not essential.

Learners should be encouraged to discuss their own, their peers' and others' views on the effects, in design and craft of using 3D materials. Learners should use the correct technical terms when discussing the materials and techniques they have used and the effects they have created in their work. Regular feedback should be given to learners through day-to-day discussion and formal and informal interim assessment. Evidence of evaluation for learning outcome 4 can also take the form of notes, formal evaluative statements and a record of verbal feedback.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Introduction to unit and structure of the programme – whole class.
Creating photographs using photographic techniques – whole class.
Photographic media – whole class.
Photographic technology – whole class.
Review own use of photographic materials, techniques and technology – whole class.
Assignment 1: Packaging for Fragile Objects Learners individually plan and produce 3D design for an identified purpose, collating evidence of exploration in their sketchbook. Pre-production techniques: ● identify purpose: client requirement, target audience ● generate ideas: analysis of researched images, identification of techniques, Identification of own technical and aesthetic preferences ● develop ideas: reflection upon creative intentions ● plan media: technology selection, preparations and priorities. Presentation; ideas for own 3D designs. Production; apply production techniques. Review: own use of 3D materials, techniques and technology.
Learner initiated study.
Assignment 2: Research 3D Media, Techniques and Technology Learners work in small groups to prepare an individual media, techniques and technology research folder to include: Researched material with learner annotation and summaries of: ● selected 3D media ● selected 3D technology ● selected 3D techniques. Summaries of the suitability of selected 3D and techniques. Description of the suitability of selected 3D technology for identified purposes.
Learner-initiated study.

Topic and suggested assignments/activities and/assessment
Assignment 3: Create 3D Artefacts Learners individually plan and produce 3D for an identified purpose, collating evidence of exploration in their sketchbook. Pre-production techniques: - Identify purpose: client requirement, target audience. - Generate ideas: analysis of researched images, identification of techniques, identification of own technical and aesthetic preferences. - Develop ideas: reflection upon creative intentions. - Plan media: technology selection, preparations and priorities. Presentations: ideas for own 3D designs. Production: apply production techniques. Review: own use of 3D materials, techniques and technology.
Learner-initiated study.
Review of unit and assessment.

Assessment

For P1, P2 and P3 must use a range of making skills safely and effectively, and to communicate the characteristics and properties of the 3D materials used.

To achieve these criteria, learners are expected to use a range of making skills in either a variety of materials or in a single specialism. Evidence should include a range of studies and samples showing how their skills have developed and showing an awareness of safe working practices. Evidence of experiments may also be provided through records in worksheets, sketchbooks, notes or in folders of collected material, demonstrating the learner's clear understanding of the characteristics and properties of materials. Much of the clarity will be driven by tutor support, guidance and direction.

For P4, learners must use generally correct terminology when discussing their work and their use of 3D. There should be reflection on learners' choices and use of materials and techniques through formal evaluations, annotated sketches or worksheets, via a presentation to the class or witness statements. Using any of these methods, learners need to evidence their understanding of the properties of media, materials and techniques.

For M1, M2 and M3 learners should combine practical research, demonstrations and secondary sources to describe, investigate and exploit the characteristics and properties of diverse 3D materials.

Learners should safely experiment with and develop ideas using their understanding of the materials and processes. Learners should demonstrate a deeper practical understanding of media, materials and techniques, using a broader range of materials and processes than at pass level. They should demonstrate a greater awareness of skills and knowledge gained in their discussion of their work and use mainly correct technical terms. Assessment evidence for these criteria can take a similar format to that for P1, P2 and P3.

For M4, learners should use mainly correct and appropriate terminology when discussing their work and their use of 3D. There should be reflection on learners' choices and use of materials and techniques and consideration of improvements for future work.

For D1, more detailed descriptions of working properties and characteristics are required, which more fully address the indicative *Unit content*. This should be linked to practical investigations and use of 3D for D2 and D3. Learners should be working more independently and showing innovation in the ways they work with and

across techniques and technology. Learners' ideas, experiments and outcomes should be explored creatively and fluently.

For D4, learners must generate a wide range of ideas and critically review and refine their designs and ideas. They should be able to analyse their choices of materials and techniques with a high level of sophistication and imagination and with increasing independence. Learners should show confidence in their ability to reflect on the effectiveness of their decision making in their creative work.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P2, P3 M2, M3 D2, D3	**Assignment 1:** Packaging for Fragile Objects	Designer to create packaging for wire jewellery.	Documents, diagrams and evidence of 3D experimentation to confirm appropriate use of materials for a specific purpose.
P1, P2, P3 M1, M2, M3 D1, D2, D3	**Assignment 2:** Research 3D Media, Techniques and Technology	Jeweller investigating new techniques.	Portfolio evidence of research and investigation of 3D media.
P1, P2, P3, P4 M1, M2, M3, M4 D1, D2, D3, D4	**Assignment 3:** Create 3D Artefacts	Furniture designer creating new range.	Portfolio evidence of choice of materials and technology influencing development of own ideas, to achieve a 3D outcome. Portfolio evidence of analysis and evaluation to justify own proposals. References to health and safety practices. Completed artefact(s).

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Art and Design sector suite. This unit has particular links with the following unit titles in the BTEC Art and Design suite:

Level 1	Level 2	Level 3
Explore 3D Design	Using Ideas to Explore, Develop and Produce Art and Design	Visual Recording in Art and Design
Explore 3D Design Crafts	Working with 3D Design Briefs	Materials, Techniques and Processes in Art and Design
Introduction to 3D Design Products	Working in Product Design	Ideas and Concepts in Art and Design
Creative Use of Materials, Techniques and Processes	Working in Spatial Design	Contextual Influences in Art and Design

Level 1	Level 2	Level 3
Explore and Create Surface Relief		Small-scale Working
		Small-scale Design
		Human-scale Working
		Human-scale Design
		Large-scale Working
		Large-scale Design

National Occupational Standards

This unit also provides development opportunities for some of the underpinning skills, knowledge and understanding of the following National Occupational Standards:

CCSkills Sector Skills Council

Design (revisions in draft form June 2009)

- DES1 Apply research on the history and theory of design to your own design activities
- DES2 Apply design industry knowledge to inform your own design work practice and work
- DES3 Use Critical Thinking Techniques in your design work
- DES7 Contribute to the production of prototypes, models, mock-ups, samples or test pieces.

Essential resources

Learners need access to a range of media, materials and associated tools and equipment as well as adequate work and storage space. Studio and workshop space that is suitable for a range of experimental studies and making activities is essential for this unit. Library and learning facilities that enable learners to access examples of 3D design and craftwork should be available. Access to a range of digital applications would also be beneficial.

Employer engagement and vocational contexts

Centres should develop links with practising artists, craftspeople and designers, to deliver assignments to learners or to provide work experience.

Links with employers are essential to the delivery of the programme for work experience and future employment.

Vocational learning support resources:

- Learning and Skills Network – www.vocationallearning.org.uk

Business and finance advice:

- local and regional Business Link – www.businesslink.gov.uk

Assignments should be vocationally relevant; centres should consider the delivery of 'live projects' for example to support the vocational content of the unit and programme.

Creative and Cultural Skills (www.ccskills.org.uk), the Sector Skills Council for Arts, Crafts and Design has launched the web portal Creative Choices (www.creative-choices.co.uk). This portal has a range of information about careers in the arts, crafts and design sector, including job descriptions.

Indicative reading for learners

Textbooks

Ashby M – *Materials and Design: The Art and Science of Material Selection in Product Design* (Wright, 2004) ISBN 978-0723611318

Brownell B – *Transmaterial 2: A Catalog of Materials That Redefine Our Physical Environment* (Princeton Architectural Press, 2008) ISBN 978-1568987224

Lefteri C – *Materials for Inspirational Design* (RotoVision, 2006) ISBN 978-2940361502

Lesko J – *Industrial Design: Materials and Manufacturing Guide* (Wiley, 2008) ISBN 978-0470055380

McGrath J – *The Encyclopaedia of Jewelry-Making Techniques: A Comprehensive Visual Guide to Traditional and Contemporary Techniques* (Running Press, 1995) ISBN 978-1561385263

Journals

Crafts

Design Week

Eco Design

Fine Scale Modeller

Inventables

Modelmaker

Websites

www.craftscouncil.org.uk	Crafts Council
www.designcouncil.org.uk	Design Council
www.inventables.com	Links for buyers and vendors of materials and technologies
www.solidworks-cpd.co.uk	Solidworks software

Delivery of personal, learning and thinking skills

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
Independent enquirers	planning and carrying out research into specialist 3D design media techniques and technology
Creative thinkers	exploring 3D design media techniques and technology and generating informed ideas
Reflective learners	reviewing, reflecting on and evaluating their own and others' work
Team workers	collaborating with others to develop ideas, concepts, proposals, techniques and processes
Self-managers	organising time, planning resources, handling budgets when working to a specialist project brief, whether working on own or as part of a design team
Effective participators	allowing for their own and others' requirements and proposals to be respected, considered, reviewed and actioned where appropriate.

Although PLTS are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	planning and carrying out research into 3D design media, techniques and technology carrying out research to implement chosen media, techniques and technology in their own design work
Creative thinkers	trying out alternative ways of developing their concepts, following ideas through to complete a design brief, adapting their ideas as circumstances change
Reflective learners	setting goals with success criteria for their design work inviting feedback on their own work and dealing positively with praise, setbacks and criticism evaluating their experiences and learning to inform future progress
Team workers	working as part of a design project team, taking responsibility for their own role managing discussions to reach agreements and achieve results
Self-managers	seeking out challenges or new responsibilities and showing flexibility when priorities change dealing with competing pressures, including personal and work-related demands responding positively to change, seeking advice and support when needed
Effective participators	implementing opportunities, during a project schedule, to allow for their own and others' requirements and proposals to be respected, considered, reviewed and actioned where appropriate allowing project scheduling to encompass implementation of action points.

Functional Skills – Level 2

Skill	When learners are …
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	researching 3D design media, techniques and technologies
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	planning for a design project which involves investigating, understanding and demonstrating 3D design media, techniques and technologies
Manage information storage to enable efficient retrieval	developing appropriate methods of storing visual and written materials relating to the design project
Follow and understand the need for safety and security practices	creating and finding appropriate materials, techniques and processes, and adapting them for use
Troubleshoot	exploring, extracting and assessing the relevance of information from design-related specialists and associated sources
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	creating and finding appropriate resources, materials, techniques, technologies and processes, and adapting them as principles in a design project
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	exploring and assessing the relevance of information from design-related websites
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: • text and tables • images • numbers • records	sourcing, evaluating and testing appropriate information to influence ideas, underpin proposals and effect safe use of media, materials, techniques and processes
Bring together information to suit content and purpose	implementing design proposals, bringing together a variety of ideas, concepts, materials, techniques and processes gathered through research and development
Present information in ways that are fit for purpose and audience	using specialist media, techniques and processes to present design proposals
Evaluate the selection and use of ICT tools and facilities used to present information	evaluating the appropriate use of tools and software in the design development and presentation of design proposals
Select and use ICT to communicate and exchange information safely, responsibly and effectively including storage of messages and contact lists	communicating with other members of a design project research and development team

Skill	When learners are ...
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	using appropriate calculations and tests to inform creative ideas and eventual project proposals
Identify the situation or problem and the mathematical methods needed to tackle it	considering a range of techniques, processes and materials which can be investigated through mathematical calculation
Select and apply a range of skills to find solutions	considering appropriate media, techniques, processes and specialist skills need to implement design development and project proposals
Use appropriate checking procedures and evaluate their effectiveness at each stage	implementing the appropriate project reviews to evaluate concepts and proposals
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	implementing a range of specialist techniques, processes and materials which have been proven through mathematical calculation
Draw conclusions and provide mathematical justifications	evaluating, analysing and recording findings and results of mathematical testing in the application of specialist media, techniques and processes
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	taking part in design project reviews and critiques presenting conclusions attending production meetings
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	reading information gathered from a range of visual, written and electronic sources to gather ideas, influence development and effect proposals
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	recording written research, analysis and evaluation producing design project reports which confirm choice of medial, techniques and processes, effectively, purposefully and sustainably.