Unit 95: Human-scale Working

Unit code: K/502/5266
QCF Level 3: BTEC National
Credit value: 10
Guided learning hours: 60

Aim and purpose

The aim of this unit is to develop learners' understanding of ergonomic factors through the making of human-scale artefacts. They will develop skills applying ergonomics in the design and development of their models and evaluate the quality of their results against a brief.

Unit introduction

In working through this unit, learners will demonstrate their understanding of ergonomic factors through clearly documented human-scale working ideas. They will employ ergonomics in the design and development of their models and evaluate the quality of their results against the brief.

Designers working in 3D disciplines will consider ergonomic factors when designing for specialist areas such as furniture, domestic industrial design, product and different kinds of transport design. Intelligent design can significantly improve the aesthetic and functional aspects of our lives. It can improve the efficiency and comfort of our home environment. Our journeys to and from work are made less stressful when the vehicles or transport interiors and seating are better suited to our body shape. Good design can enhance the objects, furniture and equipment we use in our everyday lives – in the kitchen, the office or workplace and the living room.

The application of ergonomics involves the designer considering the size, shape, structure and movement of the human figure when designing objects for human use. The ability of the designer to recognise these factors and build them into the design process is paramount to the success or otherwise of the item, object or product. It also involves the designer in considering the qualities and characteristics of different materials and their suitability for specific uses.

Learners will work with drawing systems to develop their design ideas, and take these into the production of maquettes and models. They will then review these outcomes against the original intentions for their proposal or brief. In this way, learners will be experiencing aspects of the design process that will provide useful and important insights that they can apply to their specialist study. They will also evaluate the characteristics of materials in terms of texture, strength, aesthetics and so on. These considerations will be supported through learners' investigations of different techniques and processes that they may use in working with materials.

Briefs should be written and presented in a vocational context in order to encourage learners to work on realistic scenarios and outcomes, taking into account any relevant legal requirements such as health and safety issues and regulations in the use of construction media and techniques as appropriate.

Learning outcomes

On completion of this unit a learner should:

1 Be able to investigate the properties of materials, techniques and processes for human-scale design

2 Be able to investigate ergonomic factors in human-scale artefacts

3 Be able to develop and communicate ideas using 3D drawing systems

4 Be able to record, evaluate and present outcomes of investigation.

Unit content

1 Be able to investigate the properties of materials, techniques and processes for human-scale design

Materials, techniques and processes: eg a range of malleable and non-malleable material eg wood, metal, plastics, card, rubber, fabrics, found or re-cycled; material and structural properties eg strength, durability, malleability; aesthetic qualities eg visual, tactile, surface qualities; working characteristics eg cutting, piercing, removing, redistributing, joining, constructing, assembling, upholstering, testing, finishing; suitability for purpose eg replicate, scale up or down, commercial outcomes, meet design intentions

2 Be able to investigate ergonomic factors in human-scale artefacts

Ergonomic factors: eg research; visual analysis; skeletal structure, muscles and body movement; functions of parts of the body; human anatomy; measurements eg human figure, projected/actual artefacts; scale, proportion; size, height, weight; comparisons eg figure to artefacts; test pieces, maquettes, models, prototype; 2D, 3D and 4D design; contextual references

3 Be able to develop and communicate ideas using 3D drawing systems

Develop and communicate ideas: eg design briefs; target client; focus; ideas; source material; contextual references; ergonomic factors; design drawing; digital imaging programmes; presentations eg different audiences

3D drawing systems: eg freehand drawings; design ideas; working drawings; presentation worksheets; perspective studies, orthographic techniques, CAD eg software programmes; photographic studies

4 Be able to record, evaluate and present outcomes of investigation

Record and evaluate: select; eg sources, ideas, media, materials, processes; analyse eg modify, adapt, refine, 3D drawing systems; review; develop; working processes; function; quality; aesthetics; intentions; working practices

Present outcomes: eg displays eg drawings, maquettes, models, prototypes, photographs, video; design sheets; statements or written analysis; storyboards; stages of development; audio visual eg digital presentation

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 investigate the properties of materials, techniques and processes for human-scale design [IE, CT, RL, TW, SM, EP]	**M1** investigate effectively the properties of materials, techniques, processes and ergonomic factors for human-scale design	**D1** demonstrate an independent approach to producing and presenting creative and innovative design solutions, that show a sophisticated understanding of materials, techniques, processes and ergonomic factors.
P2 investigate ergonomic factors in human-scale artefacts [IE, CT, RL, SM]	**M2** develop diverse ideas and present considered outcomes in a coherent way.	
P3 develop and communicate ideas using 3D drawing systems [IE, CT, SM]		
P4 record, evaluate and present outcomes of investigation. [IE, CT, RL, TW, SM, EP]		

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 focuses on the significance of design in relation to human physical needs. The majority of practical work should be related to particular areas of human need and consumption. Functional considerations will play a major part in design development and learners need to acquire a sufficient range of skills in this unit to enable them to progress in a chosen specialist area.

Learning outcome 1 can be delivered alongside learning outcome 2 through task-led exercises where learners consider the characteristics and properties of various materials in relation to human need in design. The opportunity exists for learners to make an evaluative study on a range of products from chairs to hand tools. In this way, learners may build up knowledge of how designers have used certain materials and why, considering factors such as strength and comfort. Learners should be taught to identify the factors of human need that have clearly determined the choice of materials, techniques and processes used in the making. They should also consider aspects of visual language such as sharp, soft, contrast, linear, pattern and so on. Learners will use investigative recording skills learned in other units where they will have explored and developed their visual language understanding. They will use their research recording to inform their design development and move into production of maquettes or model making. Learners should take great care to record all aspects of their design thinking and investigations in their sketchbooks or work journals, as this will form vital evidence for assessment.

In learning outcome 3 learners will use drawing systems to produce their ideas and communicate their intentions. Learners will need to be taught to use appropriate drawing systems confidently, such as freehand drawing, orthographic drawing systems, and CAD, if appropriate to the design brief or areas being studied. Learners' drawings should be clear and able to be used in presentations to target audiences, at a group critique for example, so they may need to explore a range of additional techniques such as using marker pens to highlight areas or provide three-dimensional effects to their drawing work.

Learning outcome 4 will be covered in part by the study undertaken in the other learning outcomes. As learners move through the unit, they should record their findings clearly and effectively. They should also use their sketchbooks or work journals to record their responses in reviewing their ideas and design proposals, and where appropriate showing how they have adapted or redirected the focus of their design work. This information, recorded accurately, will form a sound basis for the learners to use in any presentations to others in the group. It will also provide the tutor/s with evidence for assessment detailing how much has been learnt in addressing the key area of design for human need.

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 and activities
Introduction to the brief/explore aims and requirements of the unit. **Assignment 1**: Chair Design Stage 1: Presentation, discussion – whole group; brief focus: • primary sources for investigation • contextual references • practical considerations, constraints and factors – materials, time etc.
Stage 2: Investigation: Learners investigate and explore appropriate factors through practical experiments eg: • using body shape and different seating positions to sketch/photograph • using screen projected own and peers' body shapes to draw possible design ideas to explore ergonomic considerations in potential design ideas • investigating seating design for different purposes/occasions • possible visit to design gallery or visit by professional practitioner • investigating a range of appropriate materials techniques and processes – see 'content' section of unit • evaluating potential use and suitability of selected materials for the brief/project • recording test results and prototype developments. Group critical review and self appraisal. Learner-initiated private study time.
Stage 3: Presentation – interim evaluation and assessment Learners' presentation to the group: • considering presentation method to the group using the most appropriate techniques and illustrations • selecting and preparing annotated roughs and studies showing exploration of body shapes, ergonomic factors and seating positions • preparing and collating annotated worksheets, design sheets • summarising work researched and collected for appropriate contextual references. Learner-initiated private study time.

Topic and suggested assignments and activities
Stage 4: Development of the learner-designed chair brief • using research, explorations and feedback from 1, 2 and 3, the learner negotiates a personal brief with detailed planning • creating a series of designs viewed from different angles • modifying and refining design ideas – using digital software programmes for 3D drawing systems and 4D developments • researching further contextual references to inform and inspire ongoing work • exploring and experimenting with a range of appropriate materials • producing a range of studies, prototypes, models/maquettes to communicate ideas • reviewing and evaluating developmental studies. Learner-initiated private study time.
Stage 5: Selection and development of final design • selecting modifying, adapting and refining ideas for final design model • analysing, reviewing and refining working processes in the use of media and techniques • completing final work • evaluating whole project • identifying appropriate presentations for target audiences. Learner-initiated private study time.
Stage 6: Final presentation or display/exhibition of work.
Unit review and assessment.

Assessment

For P1, learners will be able to record and present limited information on materials, techniques and processes. The range of information will be limited, and the enquiry will be at a basic level.

For P2, learners will show a basic ability to research ergonomic factors. The range of factors explored will be limited. Language used in evaluating and explaining the effects of the factors will be basic.

For P3, learners will show a basic ability to develop ideas using 3D drawing systems. The level of skills shown will be basic, and the range of systems explored and used will be limited.

For P4, learners will show some ability to be able to produce models based on design work. The level of understanding of ergonomics addressed in the models will be basic and lack the depth shown in the higher grades. Evaluation will show a basic understanding of reviewing ideas and using findings to modify work in progress.

For M1, learners will generate imaginative design proposals using a range of drawing systems. There will be a confident use of drawing, and the design proposals will demonstrate understanding of ergonomics.

For M2, learners will be able to generate a range of models showing effective investigation of materials, techniques and processes. The work will demonstrate confidence and control of making techniques. Learners will demonstrate an in-depth understanding of ergonomics in design work. Ideas will be diverse and they will be able to make considered links between research and design ideas.

For D1, learners will demonstrate an individual approach to producing creative and innovative design solutions. Learners' work will demonstrate in-depth understanding of materials, techniques and processes. Ideas and solutions to design briefs will show a fluent ability to evaluate design work, and adapt ideas accordingly. Learners will demonstrate a high level of knowledge and understanding of ergonomics in confidently recording observations and in-depth analysis, and in presenting work effectively. This ability will be evidenced throughout work in the unit. There will be a fluent and consistent ability to recognize the key factors of ergonomics, in examples evaluated and in own 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
P1, P2, P3, P4 M1, M2 D1	**Assignment 1**: Chair Design	Designer briefed to produce chair designs for a new build Primary school	Portfolio of evidence consisting of: • research • development of ideas such as, experiments with materials, techniques relevant to proposal • final piece including presentation sheets • evaluation such as development and analysis of human-scale working ideas and final piece; strengths and weaknesses of ideas and final piece. Assessment methods might include: 1 Using witness statements to: • observe and record learner activity and their progress while working • record learners' discussions with groups and ability to communicate at tutorials • observe and record learner presentations 2 Reports of progress from work experience placements 3 Learner's own ongoing review of progress and self-evaluation evidenced through statements, notes and annotated sketchbooks/worksheets 4 Evidence of visual studies from portfolio of ongoing and final work.

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 units in the BTEC Art and Design suite:

Level 1	Level 2	Level 3
Creative Use of Materials, Techniques and Processes	3D Visual Communication	3D Computer Modelling
Working to a 3D Brief	Working with 3D Design Crafts Briefs	Exploring Resistant Materials
	Working with 3D Design Briefs	Human-Scale Design

Essential resources

Learners will need access to a range of visual and technical resources including photographic facilities. The workshops should be equipped to a good standard for work with a wide range of materials and include a separate area for wet work and mould making, a heat treatment area with appropriate extraction facilities, a clean area for drawing and preparation, a finishing area, and storage space for work in progress.

Resources for research should include access to design areas and drawing studios for recording from primary sources, ideas origination and for project development will be essential. Both specialist and general learning support materials including books, journals, periodicals, computer access to the internet together with a range of design software are necessary to support learners in their historical, cultural and contemporary contextual research and in their use of 4D design application.

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 design have launched the web portal Creative Choices (www.creative-choices.co.uk). This portal has a range of information about careers in the design sector, including job descriptions.

Indicative reading for learners

Textbooks

Bridger R S – *Introduction to ergonomics* (CRC, 2008) ISBN 978-0849373060

Buxton B – *Sketching User Experiences: Getting the Design Right and The Right Design – Interactive Technologies* (Morgan Kaufman, 2007) ISBN 978-012374037

Feill C and P – *Design of the 20th Century* (Taschen, 2005) ISBN 978-3822840788

Feill C and P – *Design of the 21st Century* (Taschen, 2005) ISBN 978-3822840789

Hedge A – *Human Factors and Ergonomics for Design* (John Wiley and Sons Ltd, 2007) ISBN 978-0471757993

Lefteri C – *Materials for Inspirational Design* (RotoVision, 2007) ISBN 978-2940361502

Lidwell W – *Universal Principles of Design: 100 Ways to Enhance Usability, Influence Perception, Increase Appeal, Make Better Decisions and Teach Through Design* (Rockfort Publishers Inc, 2003) ISBN 978-1592530076

McDermott C – *Essential Design* (Bloomsbury, 1994) ISBN 978-0747519362

Mills J W – *The Techniques of Sculpture* (Batsford, 1985) ISBN 978-0713425093

Mitton M – *Interior design visual presentation* (John Wiley, 2008) ISBN 978-0471741565

Newman T R – *Plastic as an Art Form* (Chilton Book Co., 1972) ISBN 978-0273318637

Norman D A – *Emotional Design* (Basic Books, 2005) ISBN 978-0465051366

Norman D A – *The Design of Everyday Things* (Basic Books, 1998) ISBN 978-0262640374

Norman D A – *The Design of Future Things* (Basic Books, 2007) ISBN 978-046500227

Slack L – *What is product design? Essential design handbooks* (RotoVision, 2006) ISBN 978-2940361243

Weizhi C – *Big Book of Creative Product Design* (Links International 2008) ISBN 978-8496969254

Journals

AN Magazine

Blueprint

Crafts

Creative Review

Design

Design issues

Eco Designer

Make

Nest

Schmuck

Space

World of Interiors

Websites

www.burrows.com/found.html	Art and Crafts links
www.coshh-essentials.org.uk	Information to help firms comply with the Control of Substances Hazardous to Health Regulations
www.designcouncil.org.uk	The national strategic body for design
www.designboom.com/eng/education/rockingchair.html	Links and information on design
www.designobserver.com/archives/category.html	Publications and articles about design
www.designthinking.ideo.com	Design blog
www.desktoppublishing.com/design.html	Graphic design and DTP links
www.eyemagazine.com	Eye magazine online
www.intute.ac.uk/artsandhumanities/visual	Art and design links supported by several universities
www.vam.ac.uk/?view=compliant	The Victoria and Albert museum website

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	investigating the properties of materials, techniques and processes for human-scale working investigating ergonomic factors in human-scale artefacts developing and communicating ideas using 3D drawing systems recording, evaluating and presenting outcomes of investigation
Creative thinkers	investigating the properties of materials, techniques and processes for human-scale working investigating ergonomic factors in human-scale artefacts developing and communicating ideas using 3D drawing systems recording, evaluating and presenting outcomes of investigation
Reflective learners	investigating the properties of materials, techniques and processes for human-scale working investigating ergonomic factors in human-scale artefacts recording, evaluating and presenting outcomes of investigation
Team workers	investigating the properties of materials, techniques and processes for human-scale working
Self-managers	investigating the properties of materials, techniques and processes for human-scale working investigating ergonomic factors in human-scale artefacts developing and communicating ideas using 3D drawing systems recording, evaluating and presenting outcomes of investigation
Effective participators	investigating the properties of materials, techniques and processes for human-scale working recording, evaluating and presenting outcomes of investigation.

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	researching the brief; selecting contexts and sources for recording originating and developing human-scale working ideas reviewing and refining ideas towards completed work planning and preparing presentations of final work
Creative thinkers	recording from sources and contexts in different creative ways using media, materials and processes imaginatively originating and developing creative ideas working on final pieces presenting work to different audiences creatively and imaginatively
Reflective learners	evaluating the different stages of project development reviewing ideas and listening to feedback at tutorials and crit sessions final evaluation when presenting human-scale working ideas to different audiences
Team workers	working with the group to analyse the brief and develop plans for research and ideas for development group evaluations and feedback sessions working on final displays or exhibitions and presentations
Self-managers	working independently to further their research studies planning the development of their work to meet the project brief developing ideas and regularly reviewing their progress selecting best ideas and deciding on ways forward planning and preparing presentations
Effective participators	participating in group discussions and evaluations working on group projects taking part in presentations.

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	scanning and developing human-scale working ideas digitally using software programmes to develop image creation researching contextual and other information for the development of ideas for human-scale working brief
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	planning project briefs and where and how ICT might be used when appropriate evaluating outcomes and the appropriateness of medium
Manage information storage to enable efficient retrieval	researching from internet sources; downloading information creating folders for storage and retrieval
Follow and understand the need for safety and security practices	induction into use and practice of ICT
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	researching internet sources, selecting from their research, developing own response informed by research
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	researching information for different briefs and activities evaluating results of using digital research methods
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	designing digitally; using scanners; inputting and formatting information from sources
Bring together information to suit content and purpose	developing design ideas digitally; importing visual and textual information relevant to brief/activity
Present information in ways that are fit for purpose and audience	using digital means to plan, create and give presentations to different audiences
Evaluate the selection and use of ICT tools and facilities used to present information	assessing their progress and commenting on the appropriateness of their selection of ICT tools and facilities – eg use of software programmes
Select and use ICT to communicate and exchange information safely, responsibly and effectively including storage of messages and contact lists	using email to submit written work; downloading information from internet sources; storage of information – creating folders for access

Skill	When learners are ...
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	recording visually: scaling, timing, measuring using perspective and other methods of projection
Identify the situation or problem and the mathematical methods needed to tackle it	using measuring and orthographic projection for accuracy, and scaling using software to observe and modify human-scale working ideas from different viewpoints
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	discussing the project brief describing the physical properties and characteristics of different human-scale working materials contributing to group discussions and the sharing of ideas evaluating own and others human-scale working presenting to target audiences
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	researching, reading, selecting text and images annotating, commenting and comparing using contextual texts and images to relate to own human-scale working ideas evidencing understanding through discussion, crit sessions, evaluations and presentations
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	evaluating results of human-scale working to meet the brief annotating recordings and ideas for judgement of qualities and appropriateness in the use of selected 3D media, materials and techniques analysing and evaluating selected artists' images for the purpose of developing own work, using personal judgements and relating research to own ideas preparing presentations of final work.