Curriculum Overview – Design Technology

Howden School

THE CONSORTIUM ACADEMY TRUST

Shaping Positive Futures

Introduction

This document outlines the curriculum and key considerations including:

- Aims and purpose
- Alignment with the whole school provision and curriculum intent
- A summary programme of study which includes sequencing of taught content

We use the National Curriculum as our statutory foundation and broadly share its principles and aims including:

- 'To provide pupils with an introduction to the essential knowledge that they need to be educated citizens. To introduce pupils to the best that has been thought and said; and help engender an appreciation of human creativity and achievement'.
- To prepare students to be confident in themselves, to have a fulfilled and successful life beyond our school – one where they contribute positively to society.
- Our statutory curriculum is just one element in the education of every child. There is time and space in the school day and in each week, term and year to range beyond statutory specifications.
- Provision of a framework of core knowledge around which teachers can develop exciting and stimulating lessons to promote the development of pupils' knowledge, understanding and skills as part of the wider school curriculum.
- The wider school curriculum includes an extensive range of opportunities and activities that are routinely available to students, are inclusive and reflect our diverse community.

Numeracy and literacy

Teachers should take opportunities to develop pupils' mathematical fluency, spoken language, reading, writing and vocabulary within their specific discipline and in line with the expectations laid out in our school curriculum statement.

Purpose of study

'Design and technology is an inspiring, rigorous and practical subject. Using creativity and imagination, pupils design and make products that solve real and relevant problems within a variety of contexts, considering their own and others' needs, wants and values. They acquire a broad range of subject knowledge and draw on disciplines such as mathematics, science, engineering, computing and art. Pupils learn how to take risks, becoming resourceful, innovative, enterprising and capable citizens. Through the evaluation of past and present design and technology, they develop a critical understanding of its impact on daily life and the wider world. High-quality design and technology education makes an essential contribution to the creativity, culture, wealth and well-being of the nation.' Adapted from National Curriculum, DfE, 2014.

Curriculum Intent

The Howden School curriculum for design technology aims to ensure that all pupils:

- develop the creative, technical and practical expertise needed to perform everyday tasks confidently and to participate successfully in an increasingly technological world
- build and apply a repertoire of knowledge, understanding and skills in order to design and make high-quality prototypes and products for a wide range of users
- critique, evaluate and test their ideas and products and the work of others

Building on prior learning - What can students do by the end of KS2?

Design

- use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups
- generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design

Make

- select from and use a wider range of tools and equipment to perform practical tasks, such as cutting, shaping, joining and finishing, accurately
- select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities

Evaluate

- investigate and analyse a range of existing products
- evaluate their ideas and products against their own design criteria and consider the views of others to improve their work
- understand how key events and individuals in design and technology have helped shape the world

Technical knowledge

- apply their understanding of how to strengthen, stiffen and reinforce more complex structures
- understand and use mechanical systems in their products, such as gears, pulleys, cams, levers and linkages
- understand and use electrical systems in their products, such as series circuits incorporating switches, bulbs, buzzers and motors
- apply their understanding of computing to programme, monitor and control their products.

What are the knowledge/skills gaps?

Generally, the technical knowledge is not covered in as much depth as design process activities. Pupils have limited exposure to mechanical systems and electronic systems in most primary schools. Some pupils arrive with limited understanding of computer programmes, although most have covered basic coding in primary school.

Lack of workshop facilities means many pupils arrive with limited fine motor skills with application to hand tools such as saws and drills.

KS3 Baseline expectations

- Ability to use different media to research
- Communicate designs using a range of techniques
- Have an understanding of basic tools and equipment and how to use them safely
- Use basic literacy skills to discuss existing products
- Show knowledge of existing materials

Curriculum Structure

KS3 Technical knowledge – developed over the three-year programme of study

- understand and use the properties of materials and the performance of structural elements to achieve functioning solutions
- understand how more advanced mechanical systems used in their products enable changes in movement and force
- understand how more advanced electrical and electronic systems can be powered and used in their products [for example, circuits with heat, light, sound and movement as inputs and outputs]
- apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components [for example, microcontrollers]

Designing and making principles – developed over the two-year course

- understand that all design and technological practice takes place within contexts which inform outcomes
- identify and understand client and user needs through the collection of primary and secondary data
- demonstrate an ability to write a design brief and specifications from their own and others' considerations of human needs, wants and interests
- investigate factors, such as environmental, social and economic challenges, in order to identify opportunities and constraints that influence the processes of designing and making
- explore and develop their ideas, testing, critically analysing and evaluating their work in order to inform and refine their design decisions thus achieving improved
- outcomes.
- investigate and analyse the work of past and present professionals and companies in the area of design and technology in order to help inform their own ideas
- use different design strategies, such as collaboration, user-centred design and systems thinking, to generate initial ideas and avoid design fixation
- develop, communicate, record and justify design ideas, applying suitable techniques, for example: formal and informal 2D and 3D drawing; system and schematic diagrams; annotated sketches; exploded diagrams; models; presentations; written notes; working drawings; schedules; audio and visual recordings; mathematical modelling; computer-based tools
- design and develop at least one prototype that responds to needs and/or wants and is fit for purpose, demonstrating functionality, aesthetics, marketability and consideration of innovation
- make informed and reasoned decisions, respond to feedback about their own prototypes (and existing products and systems) to identify the potential for further
- development and suggest how modifications could be made

In relation to at least one of the material categories, students are required to develop and apply in-depth knowledge by:

- selecting and working with appropriate materials and components in order to produce a prototype
- using appropriate and accurate marking out methods including: measuring and use of reference points, lines and surfaces; use templates, jigs and/or patterns; work within tolerances; understand efficient cutting and how to minimise waste
- using specialist tools and equipment, appropriate to the materials or components used (including hand tools, machinery, digital design and manufacture), to create a specific outcome
- using specialist techniques and processes to shape, fabricate, construct and assemble a high-quality prototype, including techniques such as wastage, addition, deforming and reforming, as appropriate to the materials and/or components being used
- using appropriate surface treatments and finishes for functional and aesthetic purposes

Key subject skills

AO1	AO2	AO3	AO4
Identify, investigate and outline design possibilities to address needs and wants.	Design and make prototypes that are fit for purpose.	Analyse and evaluate: • design decisions and outcomes, including for prototypes made by themselves and others • wider issues in design and technology.	Demonstrate and apply knowledge and understanding of: • technical principles • designing and making principles.

Disciplinary Knowledge	Year 7	Year 8	Year 9	Year 10	Year 11
Research	Use research and exploration, such as the study of different cultures, to identify and understand user needs	Identify and solve their own design problems and understand how to reformulate problems given to them	Develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations use a variety of approaches (for example, biomimicry and user-centred design), to generate creative ideas and avoid stereotypical responses	Know the sources, origins, physical and working properties of the material categories or the components and systems, and their ecological and social footprint Understand the impact of new and emerging technologies on industry, enterprise, sustainability, people, culture, society and the environment, production techniques and systems	Identify alternative processes that can be used to manufacture products to different scales of production Understand the impact of forces and stresses on materials and objects and the ways in which materials can be reinforced and stiffened

Design	Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools	Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools	Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools	Understand how energy is generated and stored in order to choose and use appropriate sources to make products and to power systems	Demonstrate how electronic systems provide functionality to products and processes, including sensors and control devices to respond to a variety of inputs, and devices to produce a range of outputs Use stock forms, types and sizes in order to calculate and determine the quantity of materials or components required
Manufacture	Select from and use specialist tools, techniques, processes, equipment and machinery, including computer-aided manufacture Select from and use a wider, more complex range of materials, components and ingredients, taking into account their properties	Select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture Select from and use a wider, more complex range of materials, components and ingredients, taking into account their properties	Select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture Select from and use a wider, more complex range of materials, components and ingredients, taking into account their properties	Use specialist techniques and processes to shape, fabricate, construct and assemble a high-quality prototype Apply appropriate surface treatments and finishes that can be applied for functional and aesthetic purposes	Use programmable components to embed functionality into products in order to enhance and customise their operation Build mechanical devices, to produce different sorts of movement, changing the magnitude and direction of forces Use the functions of mechanical devices, to produce different sorts of movement, changing the magnitude and direction of forces
Evaluate	Analyse the work of past and present professionals and others to develop and broaden their understanding	Test, evaluate and refine their ideas and products against a specification, taking into account the	Investigate new and emerging technologies Understand developments in design and technology,	Demonstrate knowledge of the developments in modern and smart materials, composite	Evaluate how the selection of materials or components is influenced by a range of factors, such as functional, aesthetic, environmental,

		views of intended users and other interested groups	its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists	materials and technical textiles Categorise of the types and properties of materials	availability, cost, social, cultural and ethical Understand how the critical evaluation of new and emerging technologies informs design decisions; considering contemporary and potential future scenarios from different perspectives, such as ethics and the environment

Curriculum Sequencing

Key Stage 3

In KS3, design technology is taught in a rotation alongside food technology and textiles. As such, the units are relatively short in KS3 and focuses on the core subject knowledge to equip pupils with the key skills needed for future life and study. Students can opt to continue to study design and technology at KS4 and currently follow the Eduqas specification.

	Year 7	Year 8	Year 9
Knowledge	Students learn about basic workshop health & safety requirements. Students will investigate different design and drawing techniques including isometric and then design and make their own 'Block Bot' using various types of wood and other materials. Health & Safety • General health and safety rules in the workshop. • Traffic light system • Safety buttons, • PE	Students learn about amplification and use this to produce a passive amplifier for their mobile phones. Students will analyse different design and practical techniques and then design and make their own amplifier. Iterative design process • Benefits of iterative design • Explaining the key features of a product • Analysing and comparing differences of more than one product Computer Aided Design • Understand the different functions and buttons on V3 2D design and what they do.	Students learn about the Memphis style. The research and design a model and use the laser cutter to produce a precise scale model. Exploring design movements • Bauhaus • Memphis • Modernism Research Ideas • Produce a full research page of Memphis style • Use images from architecture, furniture & product design

	• Knowledge of risks and safety (universal) symbols <u>Design Ideas and Isometric drawing</u> • Knowing the difference in 2D and 3D drawings • Using isometric paper to aid production of 3D • Produce a range of samples using different practical techniques • Isometric drawings cubes, cuboids and cylinders - rendering them to show light directions <u>Using tools and equipment</u> • Transferring design ideas and choosing the correct tools for each task • Learning the properties of materials and their constraints	<u>Modelling Card</u> • Know the measurements and to manipulate card and fixings to form a prototype • Use the measurements collected from your mobile phone to transfer to your model.	• Annotate the design - How does it link to 'Memphis' style? <u>Design and development</u> • Use of the sketch up 3D modelling programme. • Transferring the design template • Checking that tabs and slits fit together • Making adjustments <u>Using the laser cutter</u> • Exporting the design • Safely use Dichloromethane to attach it together.
Skills	Developing isometric drawing techniques Crafting and rendering techniques Use of machinery - Pillar drill, linisher, hand tools	Responding creatively to the design briefs Using their understanding of others' designs by reinterpreting and applying learning in new contexts Use of the computer for design Taking measurements Fixing Cutting	Using the iterative design process to plan, prototype and evaluate a product. Linking design to that of others Measuring precisely to form a high-quality model and prototype.
Subject specific vocabulary and key terms	Design Manufacture Research Iterative design Aesthetics Hard wood Soft wood Linisher Isometric Laser cutter	MDF/Man-made board Amplify Cut, kiss cut, engrave Laser cutter Acrylic Line bending Thermoplastics Thermo-setting plastics Plotter cutter Tenon Saw	Dichloromethane Ergonomics Anthropometrics

	Research 2D design		
Assessment	Focused Assessed pieces • Final Design-Design • Final Piece-Manufacture <u>Success Criteria</u> Demonstrate the knowledge of tools, materials and skills gained during their practical activities. Reflect on how they used components, tools and materials and what went well. Evaluate what went well and determine what and how they would change certain parts in future development.	Focused Assessed piece • Design and make their own amplifier. <u>Success Criteria</u> Evaluate how effectively they have used information sources, using the results of their research to inform their judgements when developing products Adapt their methods of manufacture to changing circumstances as they solve technical problems Identify a broad range of criteria for evaluating their products, clearly relating their findings to environmental, ethical, and social and cultural dimensions.	Focused Assessed piece • Design and make a scale model chair in the Memphis style. Using ACCESSFM and the evaluation writing frame, answer the questions and make notes in purple pen. <u>Success Criteria</u> • Does it fit the brief? • Does it stand correctly? • Does it fit the style of your designer? Task 2 Evaluation: Transfer the notes that you have made with your peer into full paragraphs and sentences.

Key Stage 4 Year 10 – Long Term Planning

	Autumn term	Spring term	Summer term
Knowledge	<u>Develop drawing skills further.</u> • Isometric • 2point perspective • Plans and elevations • Exploded diagrams <u>Mini Projects</u> • Jewellery making: leather and acrylic • Pewter cast decoration • Chocolate moulds with net box • Resin Develop a deeper understanding of practical elements in D&T. Covering CAD/CAM, metal forming, vacuum forming, 3D-printing, wood	<u>Desktop Tidy Project</u> • Produce their own Client/Brief and specification. <u>Cloud-based CAD system</u> • Use sketch-up tutorials to learn basic tools and drawing processes. • Investigate form, function and production processes to respond creatively to briefs • Relate findings to environmental, ethical, and social and cultural dimensions. • Focus on size and proportions. Develop a deeper understanding of practical elements in D&T. Covering CAD/CAM, metal	NEA project commences summer term and continues into year 11. From summer term Y10 onwards lessons will be split between NEA (2 per week) and theory (1 per week) **<u>Core Technical principles</u>** • new and emerging technologies • energy generation and storage • developments in new materials • systems approach to designing • mechanical devices • materials and their working properties

	working skills and pewter casting and vacuum to develop products Using client feedback and SCAMPER evaluation, students begin design improvements and annotation of their desired product	forming, vacuum forming, 3D-printing, wood working skills and pewter casting to develop products • Using client feedback and SCAMPER evaluation, students begin design improvements and annotation of their desired product • Improve the prototype models in line with their new designs. • Create a simple flow chart to plan out the manufacturing process. • Understand properties of materials. • Compile cutting list of materials and components.	**Specialist technical principles** • selection of materials or components • forces and stresses • ecological and social footprint • sources and origins • using and working with materials • stock forms, types, and sizes • scales of production • specialist techniques and processes • surface treatments and finishes **Designing and making principles** • investigation, primary and secondary data • environmental, social, and economic challenge • the work of others • design strategies • communication of design ideas • prototype development • selection of materials and components • tolerances • material management • specialist tools and equipment • specialist techniques and processes
Skills	Numeracy – Measuring materials effectively, tolerances. Literacy – in spoken and written communication, analysis and evaluation. IT Skills – use of CAD 2D design, tinkercad, sketch up, as well as Microsoft package. Self-management – planning the time of the practical activities. Creative thinking –use of different materials and processes to produce creative products. Problem solving – Identifying the correct equipment and technique to use for a given task.	Numeracy – Measuring materials effectively, tolerances. Literacy – in spoken and written communication, analysis and evaluation. IT Skills – use of CAD 2D design, tinkercad, sketch up, as well as Microsoft package. Self-management – planning the time of the practical activities. Creative thinking –use of different materials and processes to produce creative products. Problem solving – Identifying the correct equipment and technique to use for a given task.	

Subject specific vocabulary and key terms	Pewter casting Laser cutter Prototype Evaluation Manufacture	Prototype Evaluation Manufacture Vacuum forming Metal forming Joints	
Assessment	Focused Assessed piece • Jewellery • Drawing techniques. <u>Success Criteria</u> • Demonstrate the knowledge of tools, materials and skills gained during their practical activities. • Reflect on how they used components, tools and materials and what went well. • Evaluate what went well and determine what and how they would change certain parts in future development. • Evaluate how effectively they have used information sources, using the results of their research to inform their judgements when developing products • Adapt ideas to that of their clients wishes. • Adapt their methods of manufacture to changing circumstances as they solve technical problems • Identify a broad range of criteria for evaluating their products, clearly relating their findings to environmental, ethical, and social and cultural dimensions.	Focused Assessed piece • Desk top tidy • Ongoing evaluations • Drawing techniques. <u>Success Criteria</u> • Demonstrate the knowledge of tools, materials and skills gained during their practical activities. • Reflect on how they used components, tools and materials and what went well. • Evaluate what went well and determine what and how they would change certain parts in future development. • Evaluate how effectively they have used information sources, using the results of their research to inform their judgements when developing products • Adapt ideas to that of their clients wishes. • Adapt their methods of manufacture to changing circumstances as they solve technical problems • Identify a broad range of criteria for evaluating their products, clearly relating their findings to environmental, ethical, and social and cultural dimensions.	

Key Stage 4: Year 11 – Long Term Planning

	Autumn	Spring	Summer

Knowledge	The coursework element of the course offers a unique opportunity in the curriculum for learners to identify and solve real problems by designing and making products or systems. Learners will be prepared to participate confidently and successfully in an increasingly technological world; and be aware of, and learn from, wider influences on design and technology, including historical, social/cultural, environmental and economic factors. **Technical principles** **Core knowledge and understanding** is presented in five clear and distinct topic areas: • design and technology and our world • smart materials • electronic systems and programmable components • mechanical components and devices • materials Learners are required to study all the content in these five areas, to ensure they have a broad knowledge and understanding of design and technology and that they are able to make effective choices in relation to which materials, components and systems to utilise within design and make activities. **In-depth knowledge and understanding** is presented in six clear and distinct topic areas: a. electronic systems, programmable components & mechanical devices b. papers & boards c. natural & manufactured timber d. ferrous & non-ferrous metals e. thermoforming & thermosetting polymers f. fibres & textiles Learners are required to study at least one of these six areas, to ensure they have an in-depth knowledge and understanding of a specific material area and/or components and systems to support their design and make activities. **Designing and making principles** **Core knowledge and understanding** that learners are required to develop and apply is presented in ten clear topic areas: • understanding design and technology practice • understanding user needs	Revision and examination preparation, covering the following key areas, developed throughout the course. **Core Technical principles** • new and emerging technologies • energy generation and storage • developments in new materials • systems approach to designing • mechanical devices • materials and their working properties **Specialist technical principles** • selection of materials or components • forces and stresses • ecological and social footprint • sources and origins • using and working with materials • stock forms, types, and sizes • scales of production • specialist techniques and processes • surface treatments and finishes **Designing and making principles** • investigation, primary and secondary data • environmental, social, and economic challenge • the work of others • design strategies • communication of design ideas • prototype development • selection of materials and components • tolerances • material management • specialist tools and equipment • specialist techniques and processes

	• writing a design brief and specifications • investigating challenges • developing ideas • investigating the work of others • using design strategies • communicating ideas • developing a prototype • making decisions Learners are required to cover all the content in these ten areas, to ensure they are able to apply a broad knowledge and understanding of design and technology principles within design and make activities. **In-depth knowledge and understanding** are presented in five clear topic areas: • selecting and working with materials and components • marking out • using tools and equipment • using specialist techniques • using surface treatments and finishes Learners are required to cover all the content in these five areas, in relation **to at least one of the topic areas (a to f)** identified in the in-depth knowledge and understanding section of technical principles.	
Skills	Numeracy – Measuring materials effectively, tolerances. Literacy – in spoken and written communication, analysis and evaluation. IT Skills – use of CAD 2D design, tinkercad, sketch up, as well as Microsoft package. Self-management – planning the time of the practical activities. Learning to be an independent learner with equipment. Creative thinking –use of different materials and processes to produce creative products. Problem solving – Identifying the correct equipment and technique to use for a given task.	
Subject specific vocabulary and key terms	OHMS law Current Polarity Amps Plywood MDF HIPS	

	Acrylic Sustainability	
Assessment	Theory activity which covers the whole project embedding assessment opportunities throughout Focused Assessed pieces • Final Design - Design • Final Piece - Manufacture <u>Success Criteria</u> • Demonstrate the knowledge of tools, materials and skills gained during their practical activities. • Reflect on how they used components, tools and materials and what went well. • Evaluate what went well and determine what and how they would change certain parts in future development. • Evaluate how effectively they have used information sources, using the results of their research to inform their judgements when developing products • Adapt ideas to that of their clients wishes. • Adapt their methods of manufacture to changing circumstances as they solve technical problems • Identify a broad range of criteria for evaluating their products, clearly relating their findings to environmental, ethical, and social and cultural dimensions.	**<u>Core technical principles</u>** A mixture of short answer questions covering a breadth of technical knowledge and understanding **<u>Specialist technical principles</u>** Several short answer questions (2–5 marks) and one extended response to assess a more in-depth knowledge of technical principles **<u>Designing and making principles</u>** A mixture of short answer and extended response questions. Students should know and understand that all design and technology activities take place within a wide range of contexts. They should also understand how the prototypes they develop must satisfy wants or needs and be fit for their intended use. For example, the home, school, work or leisure.