Programme of study: Design and technology (Key stage 3)

Curriculum aims

Learning and undertaking activities in design and technology contribute to achievement of the curriculum aims for all young people to become:

- successful learners who enjoy learning, make progress and achieve
- confident individuals who are able to live safe, healthy and fulfilling lives
- responsible citizens who make a positive contribution to society.

The importance of design and technology

In design and technology pupils combine practical and technological skills with creative thinking to design and make products and systems to meet human needs. In design and technology pupils learn to use today's technologies and participate in developing tomorrow's. They learn to think creatively and intervene to improve quality of life, solving problems as individuals and members of a team. Working in stimulating contexts that provide a spectrum of opportunities and draw on the local ethos, community and wider world, pupils identify needs and opportunities. They respond with ideas, products and systems, challenging expectations where appropriate. They combine practical and intellectual skills with an understanding of aesthetic, technical, cultural, health, social, emotional, economic, industrial and environmental issues. As they do so, they evaluate present and past design and technology, and its uses and effects. Through design and technology pupils become confident practically and develop as discriminating users of products. They apply their creative thinking and learn to innovate, developing their self-esteem.

Key concepts

There are a number of key concepts that underpin the study of design and technology. Pupils need to understand these concepts in order to deepen and broaden their knowledge, skills and understanding.

Designing and making

- Understanding that designing and making has aesthetic, technical, economic, environmental, ethical and social dimensions.
- Producing practical solutions that are relevant and connected to life in response to needs, wants and opportunities.
- Understanding that products and systems have an impact on quality of life.

Cultural understanding

- Understanding that designing and making reflects and influences culture and society.
- Investigating factors that have led to approaches to design and design decisions in different societies.
- Understanding how products contribute to lifestyle and choices.

Creativity

- Making links between principles of good design, existing solutions and technological knowledge.
- Recognising the significance of knowledge and previous experience, searching for trends and patterns in existing solutions, reinterpreting and applying learning in new design contexts and communicating ideas in new or unexpected ways.

Critical evaluation

- Analysing products and solutions to devise solutions to practical problems.

Economic
This includes understanding the patenting process.

Producing practical solutions that are relevant and connected to life in response to needs, wants and opportunities
Pupils should investigate what is needed, balancing risks against benefits.

Designing and making reflects and influences culture and society
This includes understanding that: designed products might reflect the values and attitudes of individual designers; individual designers might wish to use their products to influence a culture.

Investigating factors that have led to approaches to design and design decisions in different societies
This includes developing perspectives and new ways of seeing issues and problems that product developers in different societies have engaged with.

Making links
This includes seeing possibilities, problems and challenges, and visualising alternatives.

Analysing products and solutions
This includes sharing and negotiating success criteria that lead to successful practical solutions.

Key processes

These are the essential skills and processes in design and technology that pupils need to learn to make progress.

Pupils should be able to:
- generate, develop, communicate and model ideas in a range of ways, using appropriate strategies
- respond creatively to briefs, developing their own proposals and producing specifications for products and associated services
- apply their knowledge and understanding of a range of materials, ingredients and technologies to design and make their products
- use their understanding of others' designing to inform their own
- plan and organise activities and then shape, form, mix, assemble and finish materials, components or ingredients, choosing which hand and machine tools, equipment and computer-aided design/manufacture (CAD/CAM) facilities to use
- solve technical problems
- reflect critically when evaluating and modifying their ideas and proposals to improve the product throughout its inception and manufacture.

Generate, develop, communicate and model ideas in a range of ways
This includes using ICT.

Appropriate strategies
This includes devising strategies for researching, planning and testing.

Apply their knowledge and understanding of a range of materials and ingredients
This includes changing materials and ingredients into appropriate forms, utilising the properties of composite materials, and manipulating, sorting and combining materials and ingredients during processing.

Use their understanding of others' designing to inform their own
This includes observing how different solutions can resolve a problem or connecting different problems with similar solutions. Pupils should consider historical and contemporary design.

Plan and organise activities
This includes deciding how to set about tasks, sequencing activities, designing for production, developing realistic schedules, managing safe production and ensuring that communication is clear.

Solve technical problems
This includes using knowledge and understanding of how energy waste can be overcome during the production or application of a product and how the efficiency of energy use is a measure of a product's technical success.

Reflect critically when evaluating and modifying their ideas and proposals
This includes testing possible materials, components and prototypes for performance against a specification, anticipating the market, prioritising actions and organising ways forward, investigating and reconciling conflicting requirements and assessing the quality of construction and finish. It should also include testing the influence of products on their environment and reflecting on the fact that good ideas may not be feasible in practice (for example due to inherent instability).

Range and content

This section outlines the breadth of the subject on which teachers should draw when teaching the key concepts and key processes.

The curriculum should include <u>at least three of the following product areas</u>:
- food
- resistant materials
- textiles
- systems and control.

In each product area studied, pupils should focus on designing

The study of **designing** should include understanding of:
- <u>users' needs and the problems arising from them</u>
- <u>the criteria used to judge the quality of products</u>, including fitness for purpose, the extent to which the products meet a clear need, and whether resources have been used appropriately
- the impact of products beyond meeting their original purpose and <u>assessing products in terms of sustainability</u>
- aesthetic, technical, <u>constructional</u> and relevant wider issues that may influence designing, selecting materials, making and product development.

In each product area studied, pupils should focus on making

The study of **food** should include:
- a broad range of practical skills, techniques and equipment and standard recipes, and how to use them to develop, plan and cook meals and single or multiple products
- how to plan and carry out a broad range of practical cooking tasks <u>safely and hygienically</u>
- healthy eating models relating to a <u>balanced diet</u>, nutritional needs of different groups in society and factors affecting food choice and how to take these into account when planning, preparing and cooking meals and products
- the characteristics of a broad range of ingredients, including their <u>nutritional, functional</u> and <u>sensory properties</u>.

At least three of the following product areas
One or more of these areas should be studied in more depth to ensure informed pupil choice when moving on to key stage 4 and beyond.

Users' needs and the problems arising from them
This should include an analysis of where human values may conflict, for example benefits for the few or the many, for the present or the future.

The criteria used to judge the quality of products
This should include criteria for users' likes and dislikes and for overall benefit and user satisfaction. Pupils should be able to develop and use criteria.

Assessing products in terms of sustainability
This includes researching and thinking about the use of renewable sources or exploring alternatives to use in place of less sustainable materials.

Constructional
This includes considering the feasibility of solving a practical problem. For example are essential resources available or are constructional forces being properly transferred from one body to another?

Safely and hygienically
This includes understanding the principles of food safety and knowing the hygienic procedures to follow when preparing, cooking and storing food.

Balanced diet
This includes learning about the components of a healthy diet by classifying food into groups. Pupils should also understand the relationship between food, good health, growth and energy balance throughout life.

Nutritional and functional properties
This includes achieving a balanced and varied diet through a wise choice of food.

Sensory properties
This includes appreciating different flavours and using appropriate vocabulary relating to tastes that have been experienced.

The study of **resistant materials** and **textiles** should include:
- a broad range of techniques, including handcraft skills and CAD/CAM, and how to use them to ensure consistency and precision when making single and multiple products
- the behaviour of structural elements in a variety of materials
- how to use materials, technology and aesthetic qualities to design and make products of worth
- how to prepare and assemble components to achieve functional results.

The study of **systems and control** should include:
- the practical application of systems and control in design proposals
- electrical, electronic, mechanical, microprocessor and computer control systems and how to use them effectively
- how to use understanding of systems and control to assemble subsystems into more complex systems
- feedback and how a variety of inputs can give rise to a variety of outputs.

CAD/CAM
For example, using a computer-operated cutter/plotter, lathe, milling machine, rapid prototyping equipment, sewing machine.

Structural elements
This includes understanding loads and other forces, resistance to loads without deforming, and the connection and transfer of forces within a structure.

Materials, technology and aesthetic qualities
This includes recognising that new materials are being developed all the time and the tension between cost, the demands of the product and sustainability issues, such as minimising waste and reusing materials.

The practical application of systems and control
This includes managing the sequence of operations in mechanical, electrical, electronic and pneumatic or combined systems.

Assemble subsystems into more complex systems
This includes integrating subsystems to manage particular events in a larger designed and made product. For example to control the location of objects using light.

Feedback
For example using feedback from a heat sensor to trigger a mechanical action.

Curriculum opportunities

During the key stage pupils should be offered the following opportunities that are integral to their learning and enhance their engagement with the concepts, processes and content of the subject.

In ways appropriate to the product area, the curriculum should provide opportunities for pupils to:
- analyse products
- undertake focused tasks that develop skills, knowledge and understanding in relation to design and make assignments
- engage in design and make assignments in different and progressively more complex contexts
- work individually and in teams taking on different roles and responsibilities
- work with designers and makers where possible to develop an understanding of the product design process
- use ICT as appropriate for image capture and generation, data acquisition, capture and handling, controlling and product realisation
- make links between design and technology and other subjects and areas of the curriculum.

Analyse
This includes observing what is happening and linking causes with effects when a product is used.

Products
This includes their own, other pupils' and professionally designed products.

Design and make assignments
These should build on ideas developed and information acquired during product analysis, and experience gained during focused tasks.

Designers and makers
This includes electronic, mechanical and structural engineers, product designers, fashion designers, chefs, architects and others.

Use ICT as appropriate
This could include: image capture with scanners and digital cameras; image generation through computer-aided design; data acquisition through CD-ROM and internet-based resources; data capture through sensors; data handling through the use of databases and spreadsheets; controlling through the use of control programme software; and product realisation through the use of computer-aided manufacture.

Other subjects and areas of the curriculum
This includes using knowledge and understanding from other subjects and from outside the school in designing and making or using design and technology to give context and meaning to the application of other programmes of study.