

Engineer the Future: Curriculum Links

Engineer the Future has been designed to support a range of areas within the Key Stage 3 Physics and Design & Technology curricula. The opportunity provides activities for pupils to apply scientific and technical knowledge in a practical electronics context, while also developing skills in investigation, problem solving, design, testing and evaluation.

Science

Engineer the Future supports the development of scientific understanding by encouraging pupils to relate scientific explanations to phenomena in the world around them and start use modelling and abstract ideas to develop and evaluate explanation.

It also supports pupils in developing greater independence when carrying out scientific enquires. Pupils are encouraged to decide the appropriate type of scientific enquiry to undertake to answer their own questions and develop a deeper understanding of factors to be taken into account when collecting, recording and processing data. They will also evaluate their results and identify further questions arising from their findings.

Using electronics as a practical context can help students understand the social and economic implications of science in the world around them, while also increasing engagement and motivation.

Working Scientifically

Through practical activities and investigation, Engineer the Future supports a range of working scientifically skills. Relevant curriculum statements, which will be addressed throughout the student projects include:

- evaluate risks
- ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
- make predictions using scientific knowledge and understanding

- select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables
- use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety
- make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements
- present observations and data using appropriate methods, including tables and graphs
- interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
- present reasoned explanations, including explaining data in relation to predictions and hypotheses
- evaluate data, showing awareness of potential sources of random and systematic error
- identify further questions arising from their results

Physics

Engineer the Future gives pupils a practical context in which to explore electrical circuits and energy transfer. It allows pupils to connect concepts such as current, potential difference and resistance with behaviour of real circuits and components. Projects will provide students with opportunities to explore the following academic topics:

- other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels
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- electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge
- potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current
- differences in resistance between conducting and insulating components (quantitative)

Design & Technology

Engineer the Future supports the practical and creative approach outlined by the Design & Technology curriculum by giving pupils opportunities to take part in a practical and iterative process of designing and making. It encourages pupils to identify and solve problems, understand user needs, develop and communicate ideas, select appropriate tools and materials, and test and refine their work. Projects will also support the understanding of more advanced electrical and electronic systems and how programmable components can be used within products.

Designing

Projects will lead pupils to think about the purpose of a product, the needs of its users and the different ways a design problem can be approached. Pupils will also be required to develop and communicate ideas before moving on to practical construction.

Through project work, students will have opportunities to explore the following aspects of the design process:

- 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 and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations

Making

Practical electronics projects can give pupils experience of selecting and using appropriate tools, techniques, materials and components. This can also encourage



pupils to consider how properties of different components and materials influence their suitability for particular designs.

Hands-on activities will support students in developing the following practical skills:

- 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

Evaluating

Projects will support pupils in developing an iterative approach to design by encouraging them to test their work, assess how well it performs its intended purpose and make improvements accordingly. They will also provide a context for considering wider developments in technology and role of designers and engineers.

Students will be encouraged to reflect on and improve their work through the following areas of evaluation:

- analyse the work of past and present professionals and others to develop and broaden their understanding
- investigate new and emerging technologies
- test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups
- understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists

Technical Knowledge

Electronics projects provide a direct opportunity for pupils to develop their understanding of electrical and electronic systems. They can explore how components work together in a functioning product and how programmable systems can respond to inputs and control outputs.

Projects will build students' understanding of the following technical concepts and systems:

- understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists
- understand and use the properties of materials and the performance of structural elements to achieve functioning solutions
- 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]