

Unit 6D Controllable vehicles

Focus – control: electrical

ABOUT THE UNIT

In this unit, children develop their understanding of how products can be driven by electricity. They learn how to use motors within their models and how to control the speed and direction of movement. They develop their designing skills by using their own ideas and experiences to produce clearly labelled drawings. They use construction kits and a range of materials and components to develop their skills, knowledge and understanding. The children will produce a framework structure that will be controlled by an electrical circuit. The children will develop this structure with cladding and appropriate finishing techniques to create a quality product.

The vehicles made in this unit could be linked to the computer using appropriate equipment and software to enable children to experience writing procedures to control the movement and direction of their vehicles. This unit could be adapted by focusing on a particular type of vehicle *eg a circus vehicle, a carnival float, a moon buggy, a vehicle for transporting a particular load*.

This unit is an appropriate alternative to Unit 6C 'Fairground'.

PRIOR LEARNING

It is helpful if the children have:

- produced labelled drawings
- used tools safely and accurately
- made simple electrical circuits
- built a framework from square section wood
- fixed wheels and axles to a chassis

This unit builds on Units 2A 'Vehicles', 3C 'Moving monsters', 4C 'Torches', 4D 'Alarms' and 5C 'Moving toys'.

It also builds on Science Units 2F 'Using electricity', 4F 'Circuits and conductors' and on IT Unit 5E 'Controlling devices'.

VOCABULARY

In this unit, children will use words and phrases relating to:

- designing *eg design proposal, criteria, exploded diagrams, labelled drawings, improvements, construction kits, modify*
- making *eg cutting jig, cladding, finishing technique, assembling, components*
- knowledge and understanding *eg circuit, series and parallel circuits, control, motor, chassis, secure connections, switch/short circuit, pressure switch, speed, motor spindle, pulley, wheel, axle, motor mounting clip*

RESOURCES

- examples of a variety of controllable toy vehicles
- construction kits
- wire, crocodile leads, switches, aluminium foil
- batteries, battery holders, battery snaps
- motors, motor mounting clips
- pulleys (large and small), elastic bands
- square section wood, doweling, wheels, card triangles, glue
- plastic tubing
- thin and thick card, corrugated plastic
- materials for finishing *eg coloured papers, foil, fabric, coloured pens, paint*
- scissors, snips, saws, cutting jigs *eg bench hooks, mitre blocks*
- gluing jigs for square section wood, wire strippers

EXPECTATIONS

at the end of this unit

most children will:

have gained an understanding of how electricity is used to drive products; have gathered information about switches and used appropriate recording techniques; have designed and made a working toy vehicle accurately and finished it to a high standard

some children will not have made so much progress and will:

have a limited understanding of how electricity is used to drive products and will have required support to construct a basic model incorporating a motor

some children will have progressed further and will:

have designed and made a well-finished working model incorporating a motor in which they can control the speed and direction of movement; have considered the user of the toy in their design and produced a quality product with an appropriate theme; have an understanding of the use of electricity in controlling movement in familiar products; have identified the extent to which particular features of their model work and what could be done to improve them

LEARNING OBJECTIVES

CHILDREN SHOULD LEARN

POSSIBLE TEACHING ACTIVITIES

LEARNING OUTCOMES

CHILDREN

POINTS TO NOTE

INVESTIGATIVE, DISASSEMBLY AND EVALUATIVE ACTIVITIES (IDEAs)

- how a vehicle moves using wheels and axles
 - to investigate and disassemble products in order to learn how they work and how they are made
 - to communicate through labelled drawings
 - that there are different sorts of switches
- Provide some examples of controllable toy vehicles for children to investigate *eg models made from construction kits*.
 - Ask questions about how the models work *eg Where does the power come from? How are the wheels driven? What are their similarities and differences?* Discuss new vocabulary.
 - Ask the children to observe carefully how the model is constructed, how it works and how the components are joined together. Ask them to record their findings through labelled drawings *eg drawings from different views, exploded diagrams*.
 - The children could investigate examples of switches and how they work.

- describe accurately how toy vehicles work using appropriate vocabulary
- identify component parts and their functions
- make clear and accurate drawings of toy vehicles
- identify different sorts of switches and explain how they work

Links to this unit

Science: Unit 6G 'Changing circuits' (short unit)

Information technology: Unit 6C 'Control and monitoring – What happens when...?'

Literacy: Teach children to use the most appropriate form for communicating their ideas about their vehicle and to recognise that this is dependent on the stage of the process. Link this to their knowledge of different sorts of text.

Speaking and listening: Teach strategies for talking in groups *eg a procedure for dealing with different ideas or disagreement at the evaluation stage*

Content

- This unit focuses on the use of electricity to control movement in products. Children will need to learn about the use of circuits and switches, how to make secure connections, how to use motors to transfer movement to an axle and how to control the direction and speed of the movement.
- Construction kits that incorporate electrical components, including motors, are very useful in this unit. They could be used to make up models for investigation, to provide opportunities for children to practise assembling components and to investigate changing the speed and direction of movement.

Class management

- This project may have cost implications so teachers may need to organise the resources and teach the children to use them carefully.
- The framework for the chassis could be limited in size to reduce the amount of wood used.
- Use doweling for the axle and ensure that the pulley is a tight fit. Some children might need extra support for the work with circuits.

Health and safety

When carrying out a risk assessment for this activity, teachers will need to consider the materials, tools and equipment being used.

In addition, the following points should be noted:

- explain to children that they should not experiment with mains electricity and should only use batteries in commercially available appliances unless supervised by an adult
- it is not advisable to use rechargeable batteries for home-made circuits – in the event of a short circuit they could get very hot and cause injury
- children should not investigate the rotating parts of mechanisms in machines without adult supervision and only when there is no chance of a sudden rotation

Out-of-school activities and homework

There are opportunities for children to find out more about the use of electrical control through reading and looking at products.

FOCUSED PRACTICAL TASKS (FPTs)

- to assemble components to make working models
 - how to control the speed and direction of movement using pulleys and/or gears
 - how electrical circuits with switches can be used to achieve functional results
 - to use tools safely and accurately
- Ask the children to use construction kits to make models of vehicles incorporating motors. *How can the attached axle be made to turn faster or slower?*
 - Give the children a series of practical activities related to circuits:
 - revise circuits, ensure children understand the need for a complete circuit
 - incorporate a motor into the circuit – *Which way does it turn? How can the direction be changed?*
 - add a small pulley to the motor spindle. Use an elastic band to make a belt drive. Place the belt around another pulley fixed to an axle secured in a box. *Is the belt turning quickly or slowly? What happens if you change the size of the pulley?*
 - ask the children to add switches to control the circuit. Use the results of their investigations to make their own circuits and switches.
 - The children could investigate axle speed using construction kits.
 - Demonstrate the use of tools, equipment and components that children might need to use *eg wire strippers, connector strip, motor mounting clips*. Remind children how to make a wooden frame from square section wood joined with card triangles or diagonals and how to add wheels and axles. Show children how to cut wood at an angle.

- use construction kits to make working models and to investigate movement
- know how to control the speed and direction of a motor
- know how to assemble circuits incorporating motors and switches
- use tools safely and accurately to construct a simple frame

DESIGN AND MAKE ASSIGNMENT (DMA)

Design and make a controllable toy vehicle

- to generate and model ideas through discussion and drawing
 - to design and make as part of a team
 - to select appropriate tools, materials, components and techniques
 - to plan the main stages of making
 - to evaluate their work according to their design criteria and to suggest improvements
- ★ Discuss with the children the possibilities for different sorts of toy vehicles, *eg moon buggies, lorries, circus vehicles*. Discuss how these might be made from a basic chassis with cladding. *What could you do? How could you do this? What does the vehicle need to do? What will it look like? What need does the vehicle meet?*
 - ★ Discuss how the design should reflect the needs and/or style of the person who will use it. *Who are you designing for? How will you make the vehicle appear to say 'I belong to...?'*
 - ★ Ask the children to work in pairs to discuss their ideas, to set criteria and then to make labelled drawings to show how they would construct their toy vehicle, including how the electrical components would be incorporated. *Are there different ways of making this? Which could give the best results? What could we use?*
 - ★ Ask the children to list the materials and components, and tools and equipment they would need and to identify their main stages of making. *What tools would be best for this? What do you need to do first? What else could you do if it doesn't work?*
 - ★ Check the children's design proposals before starting to make.
 - ★ Encourage the children to test their models during development and to adapt where necessary. *What do the users think about it? What could you do to make it better?*
 - ★ Ask the children to evaluate their finished models against their design criteria and to suggest improvements.

- apply what they have learnt through IDEAs/FPTs in their designing and making
- work together to discuss and evaluate ideas
- use drawing as a way of modelling ideas
- select appropriate tools, materials, components and techniques for the task while considering constraints *eg time or availability of resources*
- identify the main stages of making
- work together to make a quality product
- evaluate their vehicle according to the design criteria and suggest improvements

- essential activities
- ★ assignment stages (all are essential)
- optional activities



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