Unit 5C Automata

Focus – control: mechanisms

D&T Y5
Mr Jennings' class

ABOUT THE UNIT

Children learn about controlling movement with a cam mechanism as part of an automaton. The purpose of the device is negotiated with the children. They develop their designing skills by using information sources to generate ideas and formulate an understanding of how cam mechanisms can be used to produce movement. They extend their making skills by developing techniques in cutting, shaping and joining to combine components and by selecting tools and equipment to measure and cut accurately. Through these activities they gain an understanding of the working characteristics of the materials and components and how they can be combined to create more useful properties. They consider both functional and decorative attributes in a finished product.

PRIOR LEARNING

It is helpful if the children have:

- learnt how to handle tools safely
- learnt about the working characteristics of some sheet materials
- made models with construction kits

This unit builds on Units 1B 'Playgrounds', 2C 'Winding up' and 3C 'Moving monsters'.

It also builds on Science Units 1E 'Pushes and pulls', 2E 'Forces and movements' and 4E 'Friction'.

VOCABULARY

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

- designing *eg sequence, annotated diagram, sketch, decision, choice, prototype, model, communicate*
- making *eg shape, assemble, accurate, saw, mark out*
- knowledge and understanding *eg cam, mechanism, movement, linear motion, rotary motion, pivot, off-centre, axle, force, framework, follower, guide, offset, shaft*

RESOURCES

- a collection of toys containing cams
- web images and animations of automata
- construction kits
- stiff sheet materials, *eg card, foamboard, corrugated plastic, prepared cams (shaped and off-centre wheels)*
- wooden wheels, doweling, cardboard boxes or wooden frames
- PVA glue, masking tape
- tools and equipment – bench hooks, saws, hand drill, G-cramp, round file, single-hole punch, paper drill, metal safety ruler, craft knife, cutting mats and glue gun (for teacher use)

EXPECTATIONS

at the end of this unit

most children will:	have used their knowledge of the movement made by the cam in the design of their automaton; have produced sketches and step-by-step plans and identified tools and materials; have measured, marked out and cut accurately, evaluating their work as it develops and at the end
some children will not have made so much progress and will:	have generated one viable idea after discussion with the teacher; have assembled a simple mechanism as part of the design; have used tools with some accuracy and finished their automaton in a design that they have prepared with some assistance
some children will have progressed further and will:	through discussion, have sketched ideas using their knowledge of mechanisms; have tested these ideas through prototypes before developing a set of plans to work from; have made a model which is accurate, functions well and is well finished and appropriate for the user; have compared their model to the original plan when evaluating and suggested ways to improve the finished product; have considered other ideas for cam-based automata not cased in a box

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LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE
INVESTIGATIVE, DISASSEMBLY AND EVALUATIVE ACTIVITIES (IDEAs)			
• to recognise the movement of a mechanism within a toy or model • to understand that a cam will change rotary motion into linear motion • to understand that different shaped cams produce different movements • about the relationship between a cam and a follower	∇ study web images and animations of automata and moving toys ∇ Investigate automata that contain a cam mechanism. Ask questions *eg Which parts turn? Which parts move? How are the different parts attached to allow free movement? How are the moving parts guided into place?* ∅ Look in more detail at the moving part of the toy *eg a person moving up and down. Why has the designer chosen this idea? What else could be used to make it move up and down?* ∅ Discuss the importance of the decoration surrounding the mechanism which gives the product its finished quality.	• identify the cam within a mechanism and explain how it changes movement • recognise the role of a cam and its follower in a mechanism and how cams produce movement	**Links to this unit** **Design and technology:** Units 6C 'Fairground', 6D 'Controllable vehicles' **Information technology:** Unit 5E 'Controlling devices' **Literacy:** Highlight sequence and the need for essential details only in the use of storyboards as a planning device **Speaking and listening:** Teach the conventions for group talk *eg how to achieve compromise where necessary* and identify the sorts of questions which might underpin discussion *eg to anticipate outcomes or consequences as part of the planning activity*

∇ essential activities ∅ optional activities
⊕ assignment stages (all are essential)

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LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE (cont.)
FOCUSED PRACTICAL TASKS (FPTs)			
• to measure and mark out accurately • to use tools for cutting safely and effectively • to use a drill to make an off-centre hole in a wheel	∇ Show the children a model of a cam mechanism and allow them to put together the parts as a practice. Ask them to try out different shaped cams and observe their movement. ∇ Show children cam, cam follower, cam follower guide ∇ Demonstrate to the children how to set up the bench hook, G-cramp and measure; mark out and drill a hole off-centre in the wooden wheel. ∇ demonstrate how to make a card square-section tube to form a cam guide for a model ∅ Show how to attach the doweling through the drilled hole and how to mount the mechanism into the cardboard box, emphasising the importance of measuring carefully before gluing into place. ∅ Explain the need for a guide to keep the follower in place. ∅ Show how to hold the cam in place and to stop the doweling moving once it is in place through the box. ∅ Show how a handle can be made by attaching a small wheel to one end of the axle/shaft. ∅ Show how a cardboard box can be used to house the cam, encourage the children to measure and mark all the holes needed to fit the doweling through before gluing the box together. This enables them to lay the box flat when making the holes with a punch or paper drill. The box can be glued back in place with PVA or masking tape (which can be painted over). ∇ essential activities ∅ optional activities ⊕ assignment stages (all are essential)	• measure accurately when marking out and drilling a hole in a wooden wheel • use sharp tools correctly to ensure safety	**Content** • Cams are often found in pre-school toys *eg cars and trains.* These often have the mechanism encased and are difficult to examine closely. • Teachers may need to make their own resources to illustrate the movement of cams. A simple toy could be made from a plastic bottle with off-centre wheels attached to the axle. • If you are making other teaching aids to show cams, avoid decorating or putting a finish on them or many children will want to reproduce the model you have made. • If the doweling is a very tight fit onto a drilled wheel, show the children how to use a round file to enlarge the hole gradually rather than drilling the hole bigger and having the cam too loose. • Hold the wheel in a small vice and drill horizontally. This saves making holes in the bench hooks or even the tables. Alternatively, if a vice is not available place a piece of scrap wood under the wooden wheel to be drilled.

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LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE (cont.)
FOCUSED PRACTICAL TASKS (FPTs)			
• to measure and mark out accurately • to use tools for cutting safely and effectively • to use a drill to make holes	∇ Review the children's knowledge of the operation of levers and linkages. ∇ examine levers which magnify movement, reduce movement, change the direction of movement, change linear to rotational movement (or vice versa). ∇ Show the children how a model using a cam mechanism can, together with added linkages and levers, to obtain more complex patterns of movement. ∅ make levers which magnify movement, reduce movement, change the direction of movement, change linear to rotational movement (or vice versa).	• measure accurately when marking out and drilling a holes in levers • use sharp tools correctly to ensure safety	

∇ essential activities ∅ optional activities
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LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE (cont.)
DESIGN AND MAKE ASSIGNMENT (DMA) **Design and make an automaton with a moving part, using a cam for a particular purpose**			
• to consider the characteristics of the cam mechanism when designing the moving part of their automaton • to test out their design ideas before proceeding • to cut and join with accuracy to ensure a good-quality finish to the product • to test the mechanisms and make adjustments where necessary • how to evaluate it personally and seek evaluation from others	⊕ Explain to the children that they are going to make an automaton with a moving part, using a cam. Discuss and agree the purpose of the automaton with the group. Discuss and prioritise important design criteria, considering function and visual quality of the product. ⊕ Recap on the different movements that different shaped cams make, and remind children that they might like to consider these when designing the part of the automaton that follows on from the cam. ⊕ Ask the children to brainstorm ideas for a moving toy for a particular person, sketching their most effective designs. ⊕ Encourage the children to model their ideas in card and paper first to test their designs, giving them an opportunity to suggest alternatives. ⊕ When planning, the children should develop a clear sequence of how the materials and tools should be used and how the making of the automaton will proceed. This could be done as a storyboard. ⊕ Remind the children how to use some of the tools safely. ⊕ Stress the importance of attaching the cam securely to ensure an accurate movement. ⊕ Remind them to give consideration to the finished design of the box in which the mechanism is cased, to make it as appealing as possible to the person who will receive it, or appropriate for its purpose. ⊕ Ask the children to evaluate the product against their design criteria and seek evaluations from others.	• apply what they have learnt through IDEAs/FPTs in their designing and making • show that their knowledge of cams and their movement is reflected in their designs • make a prototype to test out their design ideas • produce step-by-step plans for making their design which include the materials and tools needed • can draw up an evaluation to be carried out by others	**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 point should be noted: • glue-guns should be used under strict supervision even low melt glue can cause burns. Do not glue-gun the cam onto the doweling, use PVA or wood glue **Out-of-school activities and homework** Ask children to look for cams in toys at home or in the shops. They could draw and label the toys to show how the cam mechanism could work.

∇ essential activities ∅ optional activities
⊕ assignment stages (all are essential)