

Key learning in design & technology

Prior learning

- Experience of axles, axle holders and wheels that are fixed or free moving.
- Basic understanding of electrical circuits, simple switches and components.
- Experience of cutting and joining techniques with a range of materials including card, plastic and wood.
- An understanding of how to strengthen and stiffen structures.

Designing

- Generate innovative ideas by carrying out research using surveys, interviews, questionnaires and web-based resources.
- Develop a simple design specification to guide their thinking.
- Develop and communicate ideas through discussion, annotated drawings, exploded drawings and drawings from different views.

Making

- Produce detailed lists of tools, equipment and materials. Formulate step-by-step plans and, if appropriate, allocate tasks within a team.
- Select from and use a range of tools and equipment to make products that are accurately assembled and well finished. Work within the constraints of time, resources and cost.

Evaluating

- Compare the final product to the original design specification.
- Test products with intended user and critically evaluate the quality of the design, manufacture, functionality and fitness for purpose.
- Consider the views of others to improve their work.
- Investigate famous manufacturing and engineering companies relevant to the project.

Technical knowledge and understanding

- Understand that mechanical and electrical systems have an input, process and output.
- Understand how gears and pulleys can be used to speed up, slow down or change the direction of movement.
- Know and use technical vocabulary relevant to the project.

Product: toy fairground ride **Users:** younger children (age to be specified)

Purpose: as a toy for play and as a souvenir

Links: to history based topics, enterprise, leisure and tourism.

Context: leisure and heritage

1. Investigative and Evaluative Activities (IEAs)

At School

- Assessing prior knowledge: *What are different fairground rides called? What is your favourite ride and why? What makes a good and exciting ride? Is it horizontal, vertical or diagonal? What do you like about the appearance and design? How do you think it works? Who operates it? How does it move? How is it powered? Why do some rides have an age restriction?*

At Museum

- Investigate, analyse and evaluate products and machines from the past that incorporate gear or pulley systems. Use videos and photographs of products that cannot be explored through first-hand experience.
- Investigate traditional fairground rides. Ask questions to develop understanding e.g. *How innovative is the ride? What design decisions have been made? What type of movement can be seen? What types of mechanical components are used and where are they positioned? What are the input, process and output of the system? How well does the ride work? Why have the materials and components been chosen? How well has it been designed? How well has it been made?*
- Children could research and, if possible, visit engineering and manufacturing companies that are relevant to the product they are designing and making e.g. Jaguar Land Rover, JCB, local companies

Resources

Provided for use at school:

- *My favourite ride:* PowerPoint + Worksheet

At Museum:

- Objects & Exhibits and Costumed Guides
- Focus Educational software
- Demonstration boards for wheels, axles, gears, pulleys, drive belts
- Laminated images
- Risk Assessment
- Other Possible Resources:**
- Videos, photographs and everyday products or toys with pulleys or gears

Related learning in other subjects

- **Spoken language** – ask relevant questions, formulate and express opinions, give well-structured descriptions and explanations. Use relevant strategies to build vocabulary.
- **Computing** – use search technologies for research purposes and be discerning when evaluating digital content.
- **History** – investigate products from the past to understand change, cause, similarity and difference, and significance. To devise historically valid questions and to develop the appropriate use of historical terms.

2. Focused Tasks (FTs)

At Museum

- Using a construction kit, investigate combinations of two different sized pulleys and/or gears to learn about direction and speed of rotation e.g. *How many times does the smaller pulley turn each time the larger pulley turns once? Do the pulleys move in the same direction? How can you reverse the direction of rotation? What is the number of teeth on the two meshing gears? What is the gear ratio?*
- Build a working circuit that incorporates a battery, a motor and a handmade switch. Demonstrate the accurate use of tools and equipment including cutting and stripping wire, and making secure electrical connections. Remind children about the dangers of mains electricity. Draw a pictorial representation of the circuit or draw a circuit diagram using correct symbols.

Back at School

- Develop measuring, marking, cutting, shaping and joining skills using junior hacksaws, G-clamps, bench hooks, square section wood, card triangles and hand drills to construct wooden frames, as appropriate. Demonstrate the accurate use of tools and equipment.
- Learn about more switch options – such as a reversing switch.

Resources

At Museum

- Lego Adaptor & Focus CD ROM
- Worksheets/Instruction Sheets
- PowerPoint

- Tools and materials for making including: batteries, battery holders, wires, crocodile clips, motors, switches, aluminium foil, paper fasteners, paper clips, card, motors, motor stands, dowel, paper sticks, gears & pulleys of different sizes, elastic bands, sticky pads

Other Possible Resources:

- Junior hacksaws, glass paper, G-clamps, bench hooks, hand drill, automatic wire strippers

Related learning in other subjects

- **Spoken language** – ask relevant questions, formulate and express opinions, give well-structured descriptions and explanations. Use relevant strategies to build vocabulary.
- **Mathematics** – understand ratios. Apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm.
- **Science** – apply knowledge and understanding of circuits, switches, conductors and insulators. Recognise that some mechanisms, including pulleys and gears, allow a smaller force to have a greater effect.

3. Design, Make and Evaluate Assignment (DMEA)

At Museum

- Develop an authentic and meaningful design brief with the children.
- Complete the working circuit and rotary mechanism.

Back at School

- Generate innovative ideas by carrying out research including surveys, interviews, questionnaires and develop a design specification for their product, carefully considering the purpose and intended user for their product.
- Communicate ideas through detailed, annotated drawings from different views and/or exploded diagrams. The drawings should indicate the design decisions made, including the location of the mechanical and electrical components, how they work as a system with an input, process and output, and the appearance and finishing techniques for the product.
- Produce detailed step-by-step plans and lists of tools, equipment and materials needed. If appropriate allocate tasks within a team.
- Make high quality products, applying knowledge, understanding and skills from IEAs and FTs. Children should use a range of decorative finishing techniques to ensure a well finished final product that matches the intended user and purpose.
- Evaluate throughout and the final product in use, comparing it to the original design specification. Critically evaluate the quality of the design, the manufacture, functionality, innovation shown and fitness for the intended user and purpose.

Resources

Provided for use at school

- Questionnaire for research
- Prompt Sheets (explanation & persuasive writing)
- Additional consumable materials to complete the DMEA

Other Possible Resources:

- Junior hacksaws, glass paper, G-clamps, bench hooks, hand drill, automatic wire strippers
- PVA glue, sticky pads, masking tape, dowel, double-sided tape, card triangles, square section wood, card, corrugated plastic, finishing media

Related learning in other subjects

- **Computing** – use search technologies for research purposes and be discerning when evaluating digital content.
- **Art and design** – use and apply drawing skills. Use techniques with colour, pattern, texture, line and shape.
- **Science** – apply knowledge and understanding of circuits, switches, conductors and insulators in the design of the final product.
- **Mathematics** – understand ratios. Apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm.

Key vocabulary

pulley, drive belt, gear, rotation, spindle, driver, follower, ratio, transmit, axle, motor

circuit, switch, circuit diagram

annotated drawings, exploded diagrams

mechanical system, electrical system, input, process, output

design decisions, functionality, innovation, authentic, user, purpose, design specification, design brief, aesthetic

carousel, ferris wheel, merry-go-round, roundabout, swing boats, helter skelter

Turn, rotate, to and fro, reciprocal, arc, curve, straight line, horizontal, vertical, diagonal, linear, slide

Key competencies

- **Problem-solving**
- **Teamwork**
- **Consumer awareness**
- **Historical understanding**

Health and safety

Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

Overall potential of project

