Nuffield Design & Technology working in the curriculum

How will your roly poly move?

four and a half hours work

SECTION ONE
learning context

SECTION TWO
tasks for learning

SECTION THREE
children’s decisions

SECTION FOUR
teaching the unit

SECTION FIVE
resources and links

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design context

Most young children enjoy playing with push-along toys. A child can simply push the toy to see how fast and how far it will go. Or the child may move the toy in a series of movements as part of a fantasy in which they are involved. If two children play together they can push a single toy to and fro between them and if they have one toy each they can run races or develop intricate stories about the toys’ adventures travelling together. There are lots of possibilities, which is why they are such popular play things. In this unit children will be designing and making a simple rolling toy for themselves or someone else.

learning context

In this unit children will learn:

- to consider the performance and appearance of rolling toys for themselves and younger children; (Session 1)
- about different sorts of rolling motion and how these can be achieved by particular arrangements of wheels and axles; (Session 1)
- three different ways of fixing a tube to a paper plate; (Session 2)
- about the parts of the human face and how these create expressions; (Session 3)
- to decorate a paper plate so that it resembles a face with a particular expression; (Session 3)
- to decorate a tube so that it looks appealing when still and when it is rotating. (Session 4)
the small tasks
the focused practical tasks

1. Exploring rolling toys  
   30 minutes

2. Fixing wheels  
   60 minutes

3. Exploring faces  
   30 minutes

4. Exploring body decoration  
   30 minutes

the big task
the design and make task

The big task is to design and make a simple push-along toy (a roly poly) using a mixture of found materials, paper and card. The toy should provide amusement in both its appearance and the ways it moves. It may be for the children themselves or for other younger children.

60 minutes

The evaluation  
30 minutes

Unit review  
30 minutes

bold use of colour and a simple style create visual impact. The use of fold out tabs increases the surface area of contact between the card tube and the wheel. The tabs are used as the starting points for ‘spokes’ highlighting the off-centre fixing of the tube to the wheel
The children can decide on the following:

- the sort of movement required
  - required learning in Session 1,
  - design decision made in Session 5;

- how to achieve this movement
  - required learning in Session 1,
  - design decision made in Session 5;

- how to attach the body to wheels
  - required learning in Sessions 2 and 3,
  - design decision made in Session 5;

- the overall proportions
  - required learning in Sessions 1 and 4,
  - design decision made in Session 5;

- the appearance of the body
  - required learning in Session 4,
  - design decision made in Session 5;

- the appearance of the wheels
  - required learning in Session 3,
  - design decision made in Session 5.
exploring rolling toys

Teacher input

Explain to the class that each one of them is going to design and make a rolling toy and that the first step is to find out about how toys roll. Tell the class that on each table there is a different set of rolling toys including a roly poly – the sort of toy that they will design and make.

Pupil activity

The children can move from table to table in groups so they get the chance to investigate how toys roll including the different roly polys.

Once they have a had a chance to visit each table, ask the class the following questions.

♦ What do toys need in order to be able to roll?
♦ Which movements did you see in the different types of roly poly?
♦ Which movements are likely to appeal to young children?

♦ What sorts of decoration on the wheels are likely to appeal to young children:
  – a coloured pattern?
  – an animal face?
  – a human face?
  – if a face what sort of expression – happy, sad, well, ill, fierce, etc.?

Consolidate the learning about movement by giving the different types of roly poly a name that describes the sort of movement they make. You can use this short poem.

Three roly polys went out for the day.
Each one moved in her own special way.
One was a racer, never, ever late,
Always smooth and always straight.
One was a ditherer, fast then slow,
Never deciding how quickly to go.
One was a wanderer, left then right.
Was she going straight? No, not quite.
Just imagine if you had wheels,
Where would they be fixed?
In the middle rolling straight,
Or cleverly intermixed?

Resources

Stimulus: a variety of rolling toys with wheels, the following undecorated roly polys.

Racers – roly polys with circular wheels mounted centrally so they roll evenly, in a straight path.

Ditherers – roly polys with circular wheels mounted offset so they roll in a straight path, moving up and down as they travel.

Wanderers – roly polys with circular wheels mounted offset so they roll in a zigzag path, moving up and down as they travel.

Health and safety check

Discuss the hazards and risks involved in moving between tables and how the risks can be controlled by the way the children behave. Discuss the hazards involved in investigating rolling and how the risks can be controlled by being careful and sharing in a friendly way.
Teacher input

Tell the class that to make their roly polys they will need to know how to fix the wheels to the body and that each group will investigate the three ways to find out which will be the one for them to use. Show the children the different ways to attach the wheels to the body.

**Method 1 – dipping in PVA glue and leaving to dry**

Show the children how to dip each end of the tube into PVA glue and position onto the wheels as shown below. Note the importance of the following:

- positioning the tube centrally;
- leaving to dry (overnight preferably);
- applying pressure while drying.

**Method 2 – cutting tabs in the body and gluing with PVA glue**

Show the children how to cut small slits into each end of the tube to form tabs and to bend them out to form a gluing surface to attach the wheels. Note the importance of the following:

- cutting carefully;
- positioning the tube centrally;
- leaving to dry (overnight preferably);
- applying pressure while drying.
Method 3 – using a bracket

Show the children how to make a bracket from a strip of card and how to attach this to a wheel in a central position. Then show the children how to attach the brackets to the ends of the card tube body so that the roly poly will roll straight and even.

Pupil activity

Each group should work together to try out each of the methods. When they have finished use the following questions as the basis for a class discussion. Where possible ask the children to provide explanations.

- Which method was the quickest?
- Which method took the longest?
- Which method was the easiest?
- Which method was the most difficult?
- Which method gave the strongest join?
- Which method gave the weakest join?
- Which method would you choose?

Resources

Consumables: paper plates, card tubes, PVA glue, card strips;
Tools: scissors.

Health and safety check

Discuss the hazards and risks involved in using scissors and glue and how the risks can be controlled by careful handling and using the correct procedures.
**Teacher input**

Talk to the class about the parts of the human face and how these can be used to show expressions/feelings – eyes, eyebrows, mouth.

Ask the class to suggest words to describe expressions of faces – happy, sad, fierce, angry, calm, sleepy, puzzled, surprised. Write them on the board. Show the children how to decorate a paper plate so that it looks like a face with one of these expressions using paper cut outs and PVA glue plus peel-off/stick-on stickers. You can add detail if necessary with a felt tip pen.

**Pupil activity**

Each child can then produce a sample face that could be used as a basis for his/her own design of roly poly.

At the end of the session you can put the faces on display to act as a class reference collection for making design decisions about faces for roly polys.

**Resources**

**Consumables:** paper plates, coloured paper and white paper, felt tip pens, coloured peel-off/stick-on dots, PVA glue;

**Tools:** scissors.

**Health and safety check**

Revisit the discussion about controlling risks when using scissors and glue.
Teacher input
Show the children how to decorate the body by applying small amounts of PVA glue and winding coloured materials around the tube. Show how this looks when the tube rotates. Show how adding small amounts of shiny material will cause the body to glitter as it rolls.

Pupil activity
Each child can then produce a sample body that could be used as a basis for his/her own design of roly poly.

At the end of the session you can put the decorated tubes on display to act as a class reference collection for making design decisions about bodies for roly polys.

Resources
Consumables: card tubes, range of fabric strips, aluminium foil, metallic peel-off/stick-on shapes, sequins, PVA glue;
Tools: scissors.

Health and safety check
Revisit the discussion about controlling risks when using scissors and glue. Discuss the hazards and risks involved in using sequins and paper shapes and how the risks can be controlled by careful use.
the big task: designing and making the roly poly

Teacher input
Tell the class that the time has come for each of them to design and make their own roly polys. Explain that this will involve deciding on the following:

- the type of movement for their roly poly – straight path rolling evenly (a racer); straight path moving up and down as it travels (a ditherer); zigzag path (a wanderer);
- the tube size or length;
- the appearance of the wheels;
- the appearance of the body;
- how the wheels will be joined to the body;
- the order of doing things – join the parts first then decorate or decorate the parts then assemble.

Pupil activity
There is a ready-to-copy ‘Roly poly check list’ that the children can fill in to choose the type of movement they want. They can give a verbal reason for this; for example: “I want my roly poly to roll in a zigzag path because it is lost; that’s why the face on the wheel is looking puzzled.”

There is a ready-to-copy ‘Roly poly specification’ sheet that the children can also fill in to summarise their design decisions in more detail. If they want to draw a picture of the roly poly, then allow them to do so, but there is no need to insist on this.

The children are now in a position to produce the roly polys of their choice. Remind the children to check their roly polys against their plans as they make them. If they make any changes, they might want to show these in their pictures.

Resources
Consumables: cardboard tubes of varying lengths and widths, paper plates, coloured and white paper, strips of card of varying sizes, coloured peel-off/stick-on dots, range of fabric strips, aluminium foil, metallic peel-off/stick-on shapes, sequins, felt pens, PVA glue, ‘Roly poly check list’, ‘Roly poly specification’ sheets;

Tools: pencils, scissors.

Health and safety check
Revisit the discussion about controlling risks when using scissors, glue, sequins and paper shapes.
the big task (continued)

Extension work

Children who finish early or who require an extra challenge might be asked to do the following.

♦ Investigate the effect of fixing a weight, such as a large nail, along one side of the body of a racer roly poly to see what effect this has on the way it moves.

♦ Investigate ways to make the roly poly make noise as it moves e.g. jagged wheels or things inside the body made from a “tin” can rather than a cardboard tube.

♦ Investigate the use of paper fasteners to make the wheels on a roly poly adjustable.

Resources

Consumables: nails, adhesive tape, used drinks cans, paper fasteners, paper plates, thin card;
Tools: scissors, paper punch.

Health and safety check

Discuss the hazards and risks involved in using a paper punch and paper fasteners and how the risks can be controlled by careful use.
Session six

Evaluating the Final Product

Teacher Input

Tell the class that now is the time to evaluate their roly polys. Explain that to do this they will need to check whether the roly poly did what it is supposed to do. Remind them that they wrote this down just before they began to make the roly polys and that they should use these sheets as a reminder.

Pupil Activity

In their groups they should look at and play with the roly polys to answer the following questions about each roly poly.

- Did it move as it was supposed to?
- Did the body look as it was supposed to?
- Did the face look as it was supposed to?
- Does the person it was for like it?

There is a ready-to-copy ‘Roly poly evaluation’ sheet that the children can use to record their evaluations.

When the groups have had their discussion, ask the class the following questions.

- How could you make the roly polys look better?
- How could you make the roly polys move better?
- How could you make the roly polys last longer?

Resources

Stimulus: ‘Roly poly check list’ from Session 5, ‘Roly poly specification’ sheets from Session 5;
Consumables: ‘Roly poly evaluation’ sheets;
Tools: pencils.

Health and Safety Check

Discuss the hazards and risks involved in playing with a roly poly and how the risks can be controlled.
Teacher input

Explain to the class that it is important to think about how to get better at design & technology and that they can do this by discussing the following questions.

♦ What did you enjoy most?
♦ What did you find easy?
♦ What did you find difficult?
♦ What did you get better at?
♦ Did you help each other?
♦ What could have been done better?
♦ How could these things be done better?

Pupil activity

The children should discuss the questions in groups and when they have finished, you should ask each group to make a short report to the class. The class should agree a statement for improvement based on these reports for their next design & technology unit.

Resources

Consumables: paper;
Tools: pencils.

Health and safety check

Discuss whether the class used hazard recognition, risk identification and risk control to design and make safely.
### Session 1
- wheel, roll, path (of travel), straight, zigzag, up and down, cylinder

### Session 2
- circle, centre, tube, bracket, slit, weak, strong, easy, difficult

### Session 3
- features (on a face), expression (on a face)

### Session 4
- wind, glitter

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### Vocabulary

<table>
<thead>
<tr>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
</tr>
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</tbody>
</table>

### Resources Summary

<table>
<thead>
<tr>
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**Tools**

- scissors
- pencils, scissors
- scissors, paper punch
- pencils
Numeracy
The activities below would link this unit directly to two of the key objectives of the National Numeracy Strategy for Year 2 pupils:

1. estimate, measure and compare lengths using standard units; suggest suitable units and equipment for such measurements;
2. read a simple scale to the nearest labelled division, including using a ruler to draw and measure lines to the nearest centimetre.

Estimate which wheel would give you the longest piece of string if you put it all the way round. Which wheel would give you the shortest piece of string? Test to find out. As an extension you could try to find a wheel that would give you a piece of string in between the longest and the shortest.

Estimate the length of each piece of string. Use vocabulary such as “roughly”, “nearly” and “about” in their estimates. Measure each piece of string. How close was each estimate? Can you draw a line as long as each piece of string?

Science
There are many opportunities to develop children’s understanding of fair testing, making predictions and measuring, recording results and deciding whether the results support the predictions.

Working in pairs children could ask each other: How will this roly poly move? Like a ditherer? A racer? Or like a wanderer? and Why?

Performance of roly polys on a standard slope could be investigated. Children should be encouraged to ask questions that they might explore, e.g. “Do ditherers travel further than racers?” “Do racers with bigger wheels travel further than those with smaller wheels?” Help the children to decide what to do and how to measure. Provide children with an outline table to record results. Ask: “Did what happened match predictions?” “What might have made comparisons unfair?”

This unit would fit in very well with the QCA Science scheme of work 2E ‘Forces and movement’.
<table>
<thead>
<tr>
<th>Name:</th>
<th>type of roly poly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>racer</td>
</tr>
<tr>
<td></td>
<td>ditherer</td>
</tr>
<tr>
<td></td>
<td>wanderer</td>
</tr>
</tbody>
</table>
### Roly poly specification

<table>
<thead>
<tr>
<th>Name</th>
<th>will make a roly poly</th>
<th>the face will be like this:</th>
<th>short and fat</th>
<th>long and thin</th>
<th>short and thin</th>
<th>long and fat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>the body</td>
<td>will be</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>like this:</td>
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<tr>
<td></td>
<td></td>
<td>for me</td>
<td></td>
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<td></td>
<td></td>
<td>for someone younger</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>that runs straight</td>
<td>that dithers</td>
<td>that wanders</td>
<td></td>
<td></td>
<td></td>
</tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>my roly poly will look like this:</th>
<th></th>
</tr>
</thead>
</table>
## Roly poly evaluation

<table>
<thead>
<tr>
<th>How was it supposed to move?</th>
<th>How did it move?</th>
</tr>
</thead>
<tbody>
<tr>
<td>racer</td>
<td>racers</td>
</tr>
<tr>
<td>ditherer</td>
<td>ditherers</td>
</tr>
<tr>
<td>wanderer</td>
<td>wanderers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What was the body supposed to be like?</th>
<th>What was the body like?</th>
</tr>
</thead>
<tbody>
<tr>
<td>short and fat</td>
<td>short and fat</td>
</tr>
<tr>
<td>short and thin</td>
<td>short and thin</td>
</tr>
<tr>
<td>long and fat</td>
<td>long and fat</td>
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<tr>
<td>long and thin</td>
<td>long and thin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What was the face supposed to be like?</th>
<th>What was the face like?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Who was it for?</th>
<th>Did the person like it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>me</td>
<td>Yes</td>
</tr>
<tr>
<td>someone else</td>
<td>No</td>
</tr>
</tbody>
</table>
Acknowledgements

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