3. Investigating materials and forces

Children investigate the factors which influence the speed of roller skates, the best method to help someone get to the top of a tall tower and the strength of carrier bags.

OBJECTIVES

- To describe th simple physical properties of ae variety of everyday materials
- To identify and compare the suitability of a variety of everyday materials for particular uses.

ROLLER SKATES INVESTIGATION

To formulate a question, follow the process described on previous pages. Questions illustrated here are:

- How can roller skates be slowed down?
- How can roller skates be speeded up?

The children begin by planning their investigation. Check the children's plans and required resources for feasibility before allowing the children to carry out their investigation. Suggest modifications where necessary. An investigation is suggested here, though children should be allowed to plan their own. This idea should only be given to children who have difficulties devising their own plan.

Fair test aspects which can be incorporated (depending on the children's age and ability) are:

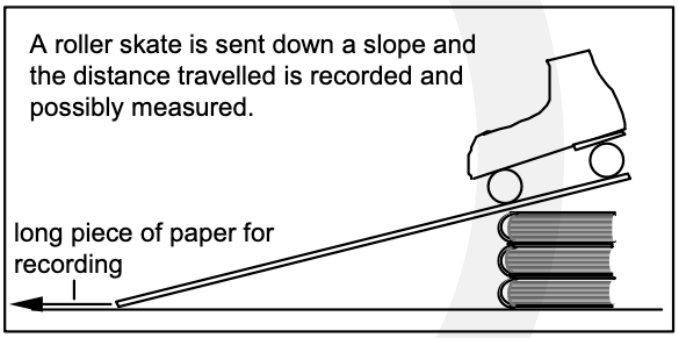
- Constant height of slope
- The skate always starts at the same position on the slope (a starting line can be drawn)
- The skate is 'released', rather than pushed each time, as it is difficult to maintain a constant push.

Resource ideas:

roller skates
slope (shelf)
sandpaper (coarse and fine)
Sellotape
double sided tape
plasticine
vegetable oil
margarine
ruler
roll of paper, e.g: wallpaper
computer paper
newsprint

teacher of 5-7 year olds
South Kirkby

We used roller skates made with Lego, which the children readily accepted.



Predictions can be made about the materials which will cause the skates to move very slowly or very quickly. Some children might want to predict the order of the materials on a 'slowest-to-quickest' scale. A record of the prediction can be kept by sticking pieces of each test material to a sheet, in a specific order. This kind of prediction can help clarify children's plans.

The simplest test would be to compare different types of roller skates, and record which ones travel the furthest, and would, therefore, be best for the prince.

On a more complex level, children can investigate the effect of changing the amount of friction between the wheels and the axle (or base of the skate), or the wheels and the slope. So, each time the skate is sent down the slope, the wheels have different materials attached. Double-sided tape can be stuck round the wheels, plasticine can be wedged between the axle and wheels, sandpaper can be wedged or stuck to axle and wheels, etc. Options may vary with the design of the roller skate and the method of joining the axle to the skate's wheels.

Margarine, cooking oil (or bicycle oil, if an adult adds this) can be added to the skate wheels and axle to reduce the friction, or 'stickiness' of the contact between the two surfaces.

Note for the teacher: *Changing the friction between the wheels and points of contact with the rest of the skate alters the speed of the turning wheels. However, changing the friction between the skate and 'road' surface alters the grip; increased friction - to a point - is a good thing, as too little friction causes the wheels to slip rather than grip.*

To **record** the distance travelled by the skate each time, lines can be drawn on a long piece of paper attached to the end of the slope. A piece of each material used can be glued beside the lines. For smaller, individual record sheets, stick pieces of material to a sheet of paper in order of the distance the skate travelled.

Reliability of data can be introduced with more able or older children, by suggesting that they repeat the 'roller run' 2-3 times, to make sure that a similar distance is reached each time. There will be some spread in the distance travelled, and children should decide whether to report the shortest, longest, or middle distance travelled by the skate (the middle of three results being the best representation of their findings).

Younger children need not take measurements, but older or more able children can measure using feet, hands, other non-standard measures, or use a ruler.

The children decide what the prince should do to outwit the princess. These decisions can be written in a letter or tape-recorded as a telephone message to the prince.

TOWER RESCUE INVESTIGATION

Formulating a question, following the process described on pages 7-8, may result in a question such as:

- How can two slippery surfaces be made more 'sticky'?

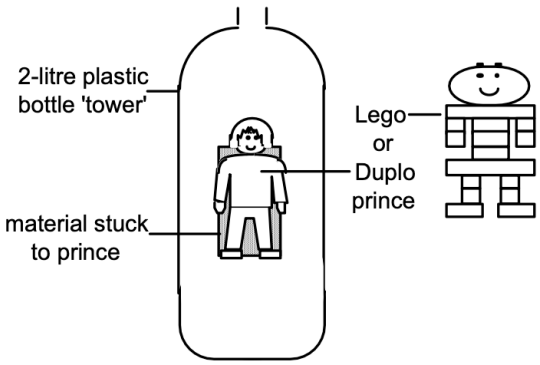
The children plan their investigations. Check their plans and required resources for feasibility before allowing the children to carry out their investigation. Suggest modifications where necessary. An investigation is suggested here, though children should be allowed to plan their own. This idea should only be given to children who have difficulties devising a plan.

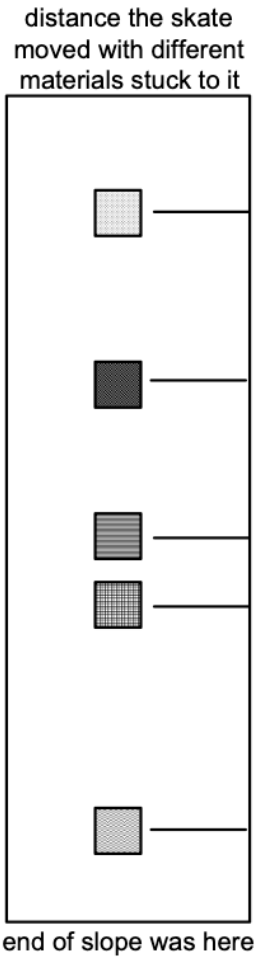
Fair test aspects which can be incorporated are:

- Same 'prince' used for all tests
- Same surface (a plastic bottle) to represent the tower
- Standard area of prince covered with the material

Predictions can be made about the materials which will help the prince stick to the smooth surface. Some children might want to predict the order of the materials on a 'best-to-worst' scale. These predictions can be used to help clarify children's plans.

A different fabric can be wrapped or glued around the prince each time he is placed on the bottle. The prince is then left on the plastic bottle, and the time recorded when he falls off.





Resource ideas:

Lego or Duplo prince
range of surfaces, e.g.
furry fabric
wool fabric
2-litre plastic bottle
viscose fabric
duster
double sided tape
bubble wrap
sandpaper
Velcro
plastic bag glue

The time can be measured using a sand timer or stopclock. If using a sand timer, the children must keep a tally of the number of times the timer is turned before the prince falls.

The test can also be carried out with each chosen material attached to both the bottle and the prince.

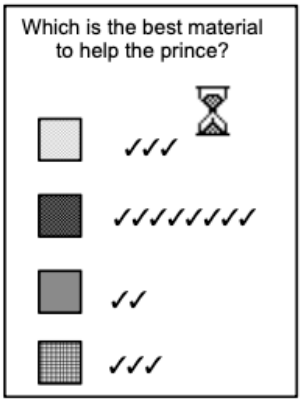
To **record** each sticking time, tallies or ticks are made beside pieces of each material glued to a record sheet.

Reliability of data can be introduced with more able or older children, by suggesting that they repeat each tower test 2-3 times. There will be some spread in the times measured, and children should decide whether to report the shortest, longest, or middle time measured (the middle of three results being the best representation of their findings).

An **alternative question** for investigation can be:

- What is the best surface for the prince to use to bounce up to the princess?

Children then investigate the 'bounciness' of a variety of surfaces. Measurement is difficult in this instance, as watching and recording how high something bounces is not easy. However, children can make a judgement on a variety of surfaces which have clearly different properties, e.g. sponge or foam compared with wood or stone.



SHOPPING INVESTIGATION

An open-ended investigation can be attempted, once children have practised investigational skills in previous activities. This investigation relates to the shopping trip with the Queen Mother. As in previous activities, children work with the teacher to formulate a question, such as those listed overleaf.

- How is heavy shopping most easily moved?
- What is the best type of bag for carrying heavy shopping?
- What is the strongest material for making a shopping bag?
- Are big bags strong enough to carry heavy shopping?

Safety Note

Ensure all bags have ventilation holes. Children must not hold the bag during the test, to prevent a full bag falling on their feet.

As children can investigate a wide range of questions, a summary of possibilities is provided below, rather than detailed guidance for investigating a particular question.

The first two questions can be investigated by giving children a range of carrying equipment or bags (e.g. rucksacks, wheeled shopping bags, carrier bags, etc.) Predictions can be made before children endeavour to move 'shopping' from one side of the room to another. The 'shopping' can be a pile of books, P.E. equipment or similar. Children can decide which was hard or easy, as well as timing how long it takes to use different methods.

The other questions above can be investigated by giving children a slightly different range of bags. The range could be bags of different materials, such as paper, plastic and cotton fabric, bags of different sizes, or bags from different supermarkets (warn children of the dangers of putting plastic bags over their heads). The children can hang each bag as shown below, and add potatoes, wooden blocks or kilogram weights to the bag, one at a time, until it breaks, or all the weights have been used. The number of potatoes each bag holds will be a simple measure of how suitable or strong the bag is. Using the arrangement shown, children's feet will be clear of the heavily laden bags which may break.

Children can record the results of their investigation in pictures, tapes or letters, as described on pages 9-10.