Science in the Making: ski investigation

This resource was developed by teachers within the Royal Society Schools Network

Ditto - just starting, 11 September 1902. From The Royal Society, NAE/1/98

Curriculum key words

Force	Friction
Forcemeter	Resistance
Rough	Smooth

Curriculum links

Working Scientifically:

- Planning different types of scientific enquiries to answer questions, including recognizing and controlling variables where necessary.
- Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings where appropriate.

Forces (Y5):

- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Equipment needed

- printed or digital copy of photograph;
- forcemeters;
- range of materials to be tested and model skiers.

Upper KS2

Introduction

This lesson uses the context of the 1902 research expedition to the Antarctic, led by Robert Falcon Scott, to investigate the best material to make a pair of skis with.

Students will create model skis using a range of different materials and use forcemeters to find the most suitable for a pair of skis.

The activities could all be covered in one, longer lesson, or could be split over two, with students planning their investigation in one and carrying it out in a second.

It would be useful if students have already used forcemeters and learned about friction, but this lesson could easily be adapted to include an explanation of what friction is and how it works, in-line with the Year 5 National Curriculum for science.

Learning objectives:

To be able to identify and control for variables when carrying out an investigation, for example by ensuring their model skis were all the same size and shape or attaching them to their model skier in the same place each time.

Success criteria (SC):

- SC1: I can plan an experiment to test the material for use at the bottom of a ski
- SC2: I can identify the variables that might affect my results
- SC3: I can carry out my experiment keeping all variables except for the one I am testing as constant as possible
- SC4: I can evaluate my results and come to conclusions.

Science in the Making: ski investigation

Starter activity: observation and deduction

(Approximately 10 – 15 minutes)

Show students a photograph of Robert Falcon Scott's 1902 Antarctic expedition in which the crew are using skis to help them get around on the snow and ice (example: Ditto - just starting (https://makingscience.royalsociety.org/s/rs/items/NAE_1_98)).

Discuss what can be seen in the photo, letting the students' observations and interests guide the discussion. You could ask:

- Where do you think this picture was taken?
- When do you think the picture was taken?
- Who do you think these people are?
- What do you notice about the people in the picture?
- What do you think the sledges are being used for?

Encourage students to ask their own questions about the picture and to explain their reasoning when they answer a question, for example asking, "What clues are there to tell you this is a cold place?" or, "Why do you think this photo must have been taken long ago?".

Activity A: context

(Approximately 5 – 10 mins)

Tell students that this photo was taken in 1902 and it shows some of the crew on an expedition to the Antarctic led by Robert Falcon Scott. You may want to show the students where the Antarctic is on a globe or using an online map.

Explain that the men on the expedition had to work in very hard conditions and often had to travel across great distances on foot, carrying heavy equipment on sledges.

To help them carry out these tasks they would travel on skis. Discuss why skis would help the explorers to move faster, highlighting the fact that smooth skis would mean less friction between the person and the snow they travelled across, meaning less effort would be required to move over longer distances.

Activity B: investigation

(Approximately 25 – 45 mins) [SC1, 2 and 3]

Tell students that we are going to investigate the best material for making a pair of skis. As we cannot ski ourselves, we will use something to represent the skier. This could be an action figure, or a small, filled bottle of water.

Look again at some images of skiers from *Science in the Making* and highlight the fact that the snow and ice being travelled over is not perfectly smooth, so we need a similarly bumpy surface to represent our snow. This could be bubble wrap, thick carpet or even a surface in the outdoors such as a field or graveled playground. The force needed to move our 'skier' can be measured using a forcemeter, which will need to be introduced and explained to students if they are not familiar with this equipment.

Show students the variety of materials available for testing. These could include paper, card, wood (lolly sticks), thin plastic (from bottles and packaging), metal (tin foil) or rock (rough or smooth stones/pebbles). Than challenge them to plan their own investigation either

individually, in pairs or in small groups. Depending on the ability of students, you could suggest models for the skier and surface to be tested, or allow them to decide on these themselves. As they plan, discuss how they are controlling different variables such as the size of the model skis and variations in suggested surfaces.

Allow students to carry out their investigation, ensuring they are collecting data on each of the different materials as they go along, and supporting with the correct and accurate use of forcemeters to measure the force required to move the model skis made of different materials over the selected surface.

Activity C: coming to conclusions

(Approximately 10 – 15 mins) [SC4]

When the students have finished carrying out their investigations, bring everyone together to discuss findings and ask them to come to a conclusion about which would be the best material for the skis of these historic explorers. It may be necessary to remind them that plastic had not yet been invented when this expedition took place, so this couldn't be used for making skis or any other equipment they would have taken.

Plenary

(Approximately 5 – 10 mins) [SC2 and 3]

It is worth spending a few minutes at the end evaluating how the experiment went. Questions such as the following will allow students to think deeply about experiements:

- What problems did you encounter and how did you overcome them?
- Did they all come to exactly the same conclusion if not then why not?
- If you were going to do this experiment again would you do it exactly the same way or would you make some improvements?

Assessment

Students will have partially met the learning objective, 'Planning different types of scientific enquiries to answer questions, including recognizing and controlling variables where necessary' if they:

- Were able to identify and control variables that would affect their results
- Were able to control these variables when carrying out their investigation, for example by ensuring their model skis were all the same size and shape or attaching them to their model skier in the same place each time.

Please note, to have fully met the requirements for this National Curriculum statement students will need to practice these skills in a range of different investigations, carried out throughout their time in upper KS2.

Resource: suggested images

Sounding sledge https://makingscience.royalsociety.org/s/rs/items/NAE_1_98

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