

HOW CAN WE SLOW DOWN HEAT LOSS FROM OUR CLASSROOM?

Teacher-led Activity

In this activity, students have the opportunity to explore the concept that heat energy flows from where it is more concentrated (hotter) to where it is less concentrated (cooler), and that this heat loss can be slowed down. The students will apply this concept to their classroom by developing and implementing strategies to reduce heat loss in their classroom. They will also be encouraged to take regular actions to conserve energy and be energy efficient.

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1. INTENDED LEARNING OUTCOMES

The students will be able to:

- Take action to increase energy efficiency in their classroom by reducing heat loss
- Describe a temperature scale in terms of hot, warm, cool and cold
- Explain that heat energy moves from where it is hotter to where it is cooler
- Describe and carry out a number of actions that can be taken to reduce heat loss and keep the classroom warm
- Use a simple outdoor thermometer to safely record and compare temperatures (optional, depending on the level of the students).

2. WHAT YOU NEED

- A portable heater, ideally a fan heater that will warm up a section of the classroom quickly (see **7. SAFETY GUIDE**)
- Outdoor thermometers (mercury thermometers are not appropriate for this activity)
- A whiteboard and whiteboard marker pens, or large paper and felt pens
- Aluminium foil (for the extension of the activity).

3. FOCUS

Ask the students questions like:

- Why do we need to keep our classroom warm in winter?
- How do we keep our classroom warm in winter?
- Why do we want to keep the warmth in our room or reduce heat loss?
- How do we reduce heat loss in our room?

4. MANAGING THE ACTIVITY

Introduction

Explain to the students that they will be investigating how heat is lost from the classroom.

- Select a safe place in the classroom and set up a portable heater. This could be any type of safe portable heater but a fan heater will heat a section of the room quickly.
- Explain to the students that the heater is being used for an experiment and explain the safety rules that need to be in place when the heater is on.
- Plug the heater in but do not turn it on.
- Clarify the students' present understanding of heat energy by asking questions like:
 - What does a portable heater do?
 - How will we know the heater is working?
 - If the heater has been on for a while, where in the room do you think it will be hottest? Where do you think it will be coldest?
- What could we do to see if our answers are correct?

Part 1: Recording Classroom Temperature

Work with the students' answers from the introduction to create an experiment where you use a thermometer to measure and record the temperature in selected areas of the room. Next, turn on the heater for long enough to significantly warm part of the classroom and then use the thermometer to record the classroom temperature in the same selected areas.

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- (i) Make a large drawing of the classroom on the whiteboard or on a large piece of paper.
- (ii) Draw in the heater, and then have the students identify the areas where the temperature was recorded.
- (iii) Enter the temperature recordings on the drawing (from measurements before and after turning on the heater).
- (iv) As a whole class, discuss the results shown on the classroom map. Identify the hottest areas, warm areas, cool areas and any cold areas. Ask the students to give reasons for this.
- (v) The drawing could be converted to a graphic colour map showing the colour codes of hot warm = red, warm= orange, cool = yellow and blue = cold or colder.

If students are familiar with thermometers, they can take numerical readings for the class to process. Alternatively, the activity is an opportunity to teach the students how to handle and use an outdoor thermometer.

For more junior students, use stickers to colour code one thermometer: red = hot, orange = warm, yellow = cool and blue = cold. Show the students the temperature reading in different parts of the room.

For more junior Level 1 students the activity could begin by introducing the vocabulary for describing changes of temperature and introducing the concept of hotter and colder using the game 'Hot or Cold' (see **8. RESOURCES**).

Part 2: Discussing the Results

- (i) Explain to the students that heat energy will flow out of any place that is warmer than its surroundings. The source of the heat energy is the heater. Therefore, the area near the heater will be the hottest, and areas further away will be cooler.
 - When the heater is turned off, the temperature in the room will even out as the heat energy flows out into the surrounding cooler air. (It may also be helpful to discuss convection – the rising movement of hot air.)
 - If a fan heater has been used, it may be necessary to explain that the heater is using the fan to send out heat in one direction only. The area behind the heater may be cooler.
 - Heat is lost through windows because the heat can move (be conducted) through the glass to the outside. Areas near windows will be cooler.
- (ii) Ask the students what they would do if:
 - The room becomes too hot
 - They want to keep as much heat as possible in the room.
- (iii) Brainstorm ways that cool air can enter your classroom. Develop a list of strategies to keep the classroom warm in winter. Ideas could include:
 - Shutting windows or doors
 - Insulating the windows with curtains or double glazing
 - Using door draught-stoppers to prevent warm air escaping and to keep out cold air

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- Doing any necessary repairs (including fixing holes, covering vents and repairing doors or windows)
- Using carpets for warmth and insulation
- Sealing gaps around windows and doors
- Opening windows (for fresh air) on a sheltered side of the room so the wind will not blow in.

(iv) Discuss the advantages and any possible disadvantages (pluses and minuses) of being energy efficient (keeping warm air in the classroom during winter).

(v) Prepare an action plan to keep the classroom warm during winter. Explain that when you follow this plan you are being energy efficient. Follow this action plan during winter.

5. REFLECTION

- Ask the students to draw their classroom in the summer when they want to keep it cool, and in the winter when they want to keep it warm. Have younger students explain their drawing. Older students may write a short explanation of their drawing.
- Ask the students to review their actions to conserve heat in the classroom. Actions could be reviewed daily at first, and then at longer intervals. Have the students decide how effective they have been in slowing down heat loss from the classroom.
- For younger Level 1 students, make two cards with one saying “We can make our classroom cooler by...” and the other

saying “We can make our classroom warmer by...”. Mix the cards face down and ask a student to come and choose one card. Read the card with the student and then have them describe one thing that could be done (e.g. open or close the door, pull the curtains, turn the heater on or off) to create the desired outcome.

6. EXTENSION

- Ask the students what they could do at home during the winter to be warm and be energy efficient by reducing heat loss.
- Experiment with a foil spinner to investigate any draughts coming through closed windows or doors (see **8. RESOURCES** for instructions on how to construct the foil spinner).
- Lead a discussion about the types of insulation that may have been used in the construction of the classroom. Ask if there is value in using carpets and curtains for insulation.
- Introduce te reo Māori vocabulary for describing changes of temperature and consolidating that vocabulary using the game ‘Hot or Cold’ (see **8. Resources** – but translate into te reo).

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7. SAFETY GUIDE

- Ensure the portable heater can be operated safely and provide relevant instructions to students to ensure they are safe while the heater is operating.
- Use only outdoor thermometers. Mercury thermometers are not suitable for this activity.
- Only ask students to open or close doors and windows if this is a safe activity for them.

8. RESOURCES

Books

- To construct a draught foil spinner see Activity 7 on page 75 of Ministry of Education, *Making Better Sense of Planet Earth and Beyond*, Learning Media, Wellington, 1999
- Ideas on common insulation types can be found on page 7 of Ministry of Education, *Building Science Concepts Book 4, Insulation: Keeping Heat Energy In*, Learning Media, Wellington, 2003.

Hot or cold?

This is a good pre-activity game for consolidating vocabulary relating to temperature.

- (i) One or two students go outside the room while the rest of the class hide an object in the classroom.
- (ii) When the student(s) come in they go to a place in the room and ask: "Is it here?". A selected student answers "Yes" or "No".

- (iii) When the student answers "No" they can give additional information like "You are very hot", "You are warm" or "You are warmer, cool, cooler or cold", depending on how close the student is to the object.

Demonstrate how the game works, then have students play until they are comfortable with the vocabulary that is used to describe a change in temperature. If the object is seen as a source of heat, then the words are describing the temperature scale away from the object.