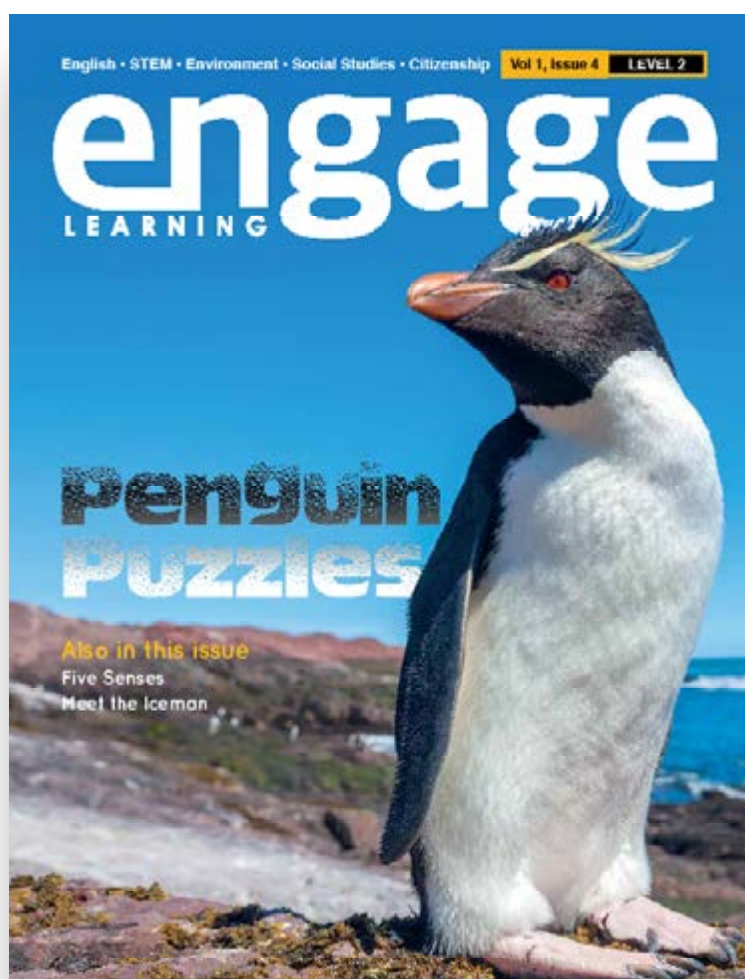


English • STEM • Environment • Social Studies • Citizenship

engage

LEARNING



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TEACHING GUIDE

Vol 1 • Issue 4 • Level 2

Ages 7–8 years

Dear Educator,

We are delighted to bring you the Teaching Guide to Issue 4 of **engage** magazine. We realize that this guide is vital to the success of using **engage** in your classroom and are dedicated to offering you the best in educational value.

So, with this issue we have updated our teaching guide with by improving our science instruction program. Through the magazine, we have given students unparalleled depth in content, and exposure to real scientists doing real science and connections to the real world. As important as reading about science is, it is not the same as doing science. Starting with this issue, the teaching guide will give you an instructional plan that incorporates hands-on activities and experiments. You will find that these activities provide real-life experiences with science and will help your students become even more successful.

The first story in this issue, 'The Five Senses,' looks at how different kinds of animals use the five senses that humans have. Some animals use their sensory organs in different ways than humans do. They also have some different sensory organs.

After looking into the eye, students will travel the world to look at different kinds of penguins. The penguins in the story allow students to learn about the variety of living things that live on Earth. Penguins have a variety of external body features and behaviours that allow them to live in different habitats.

Our last story is based on the water batteries that Sonam Wangchuk invented. You might remember him as the inspiration for the Bollywood film, *3 Idiots*. Wangchuk used basic math and science to fight the effects of global warming in Ladakh. Students will see how he used science to solve real-world problems.

Your next issue will be available at the beginning of January 2018!

CONTENTS

Five Senses	3-6
Penguin Puzzles	7-10
Meet the Iceman	11-13

MEET THESE STANDARDS

✓ LANGUAGE ARTS

- Students can use material from a given text in order to create a piece of descriptive writing.
- Students will describe the connection between form and function.
- Students will learn that active readers ask questions before they read and go back after reading to check that the text answered their questions.
- Students will continue to develop their skills in asking questions of nonfiction or informational text.

✓ LIFE SCIENCE

- Students will understand that scientists use their senses to observe and then sort and classify objects.
- Students will understand that the form of an animal and its body part determine its function.
- Students will learn that making observations is essential to the scientific process.

✓ MATH

Students will learn about geometric shapes.

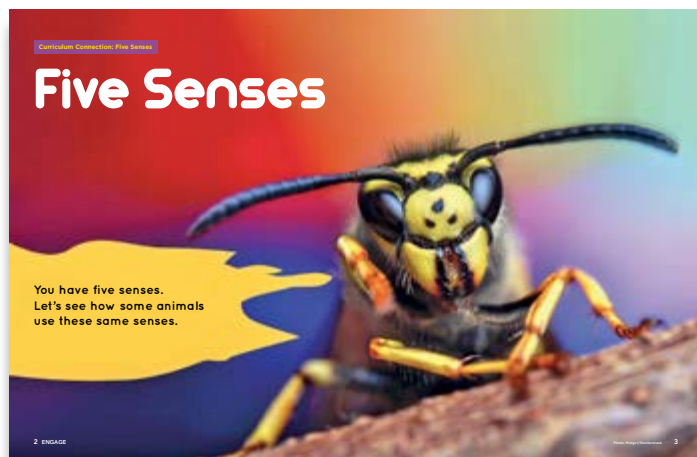
FIVE SENSES

LANGUAGE ARTS OUTCOME

Students can use material from a given text in order to create a piece of descriptive writing.

SCIENCE OUTCOME

Students will understand that scientists use their senses to observe and then can sort and classify objects.



CURRICULUM CONNECTIONS

The five senses

BUILD BACKGROUND

You need:

- chart paper
- copies of **engage** magazine
- markers

To do:

Make five groups of students in sets of 4 or 5 per group. Turn to pages 2-3 of **engage**, and hold up the photograph of the hornet hoverfly. This is one of the largest and most impressive flies in Britain. The hoverfly looks like a dangerous, stinging hornet but is actually quite harmless.

Ask questions about flies – how many kinds of flies do students know about? There are houseflies, and fruit flies. What distinguishing features do flies have? By looking at this image, how many of the five senses can the students talk about? The eyes, the mouth, and the legs are the three most obvious. Perhaps students will point out the long antennae with segments. Some student may comment on the yellow colour, which is actually part of the stripes on the body. It is named after the hornet because of similar body colouring, which then keeps predators away.

This introduction can be used to bring in the curriculum connection of the five senses. The teacher can tell the students that having looked at one of the species from the animal world, they could build a word wall about all the senses.

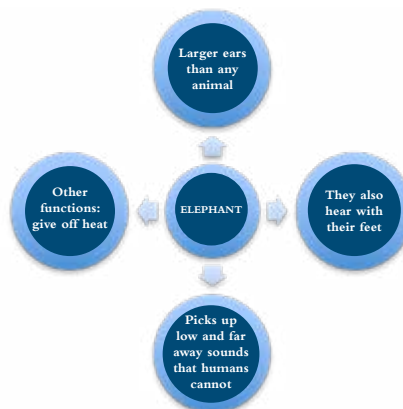
Assign each group a sense and instruct students to list all the words/phrases they can think of associated with that sense. (For example: Sight – deep green forest, colourful parrots in the trees, blue sky, a blazing yellow sun). The students will come up with a list of random words. Encourage them to write words with adjectives. Guide them to think about senses not only in themselves, but in animals as well; ask them to think about how their pets at home respond to the world.

Post all the sense charts from each group on the bulletin board. Ask the class if they would like to add anything to the “sense word wall”.

READY TO READ

Give the students copies of the engage magazine. Ask them to read pages 4-13. The story is about senses in different animals. The students will need to deconstruct the text, and create a concept map for each of the senses in the different animals.

For example: **Sense of Hearing**



- There will be a total of 7 groups making concept maps of the elephant, fennec fox, snake, komodo dragon, crocodile, spider and butterfly. Ask the students to create similar concept maps using material from the story.
- Once the concept maps are completed, the groups can then look at the sense word wall, and add some more words or phrases about the particular sense.
- Assign the groups to write a one-page narrative description.

Writing prompts:

- Compare the animal's sense to your own human sense.
- Use the photographs and the text to create your own story.
- Conduct research about the animals' environment and link how their senses help them survive. How do humans use the same sense in their own environment?
- What are some similarities and some differences?

You will be amazed at how your students' writing becomes more vivid and detailed after this cooperative writing lesson.

Have fun learning this song and teaching it in class: **Five Senses Hi 5** <https://www.youtube.com/watch?v=DTMeZ8MvlnA>

EXTENSION ACTIVITY

An excellent resource for research:

Neuroscience for kids <https://faculty.washington.edu/chudler/amaze.html>

Some animals have developed amazing adaptations to their environments. Many different types of energy fields exist in the environment, some of which humans cannot detect. The link above gives some examples of how some animals sense the outside world and the anatomical structures that allow them to do so.

[ACTIVITY: Think like a Scientist – Observe, Sort and Classify](#)

You need:

- bags with small items such as rocks, shells, beads, crayons, cloth, paper and buttons.
- paper plates – about 3 for each group.

To do:

1. Tell your students that they will be doing the work

of scientists by observing different items. Define 'observe' as what scientists do when they use their senses to gather information about something.

2. Explain to your students that scientists use their observations to sort and classify.
3. Define sort and classify as grouping objects together using similar attributes, or features, of the objects.
4. Model how to observe something by using your senses to gather information about an object. Use a small object, such as a rock, from one of the bags to illustrate this for the class. Your observations should include how the item looks and feels. For example, *I see that this rock is gray. I feel that it is rough and hard.* Emphasize that for this activity we are going to use only the sense of sight, smell and touch. If you are able to collect objects which make a sound, then use the sense of hearing as well. **DO NOT USE** the sense of taste. A word of caution, be vigilant that students do not put any small objects into their mouths.
5. Let the students sit in groups, and observe the objects and record their observations. They can then sort objects based on certain attributes they choose such as colour, texture or size and put them onto the paper plates with the appropriate labels.
6. Instruct each student to individually choose 5 objects from their group's collection. Ask students to choose one attribute they have observed in their collection sample, such as color or texture.
7. Pass out two small plates to each student. Ask students to label each plate using sticky notes. For example: Blue and Not Blue.
8. Instruct students to sort each object according to the selected attribute.
9. Tell the students that scientists are always thinking about how things can be grouped together. When we are looking closely at something, or observing, we can always think about how things can be grouped together according to how they look and feel. This helps scientists understand the world around them.

Closure: a gallery walk around the class to see how groups have sorted out the objects based on the same or different criteria.

HOW YOUR EYE WORKS

Turn to pages 14-15 of **engage**. Read the statement on the left-hand side of the diagram. "Look at your eye. Your eye is like a camera. It lets you see."

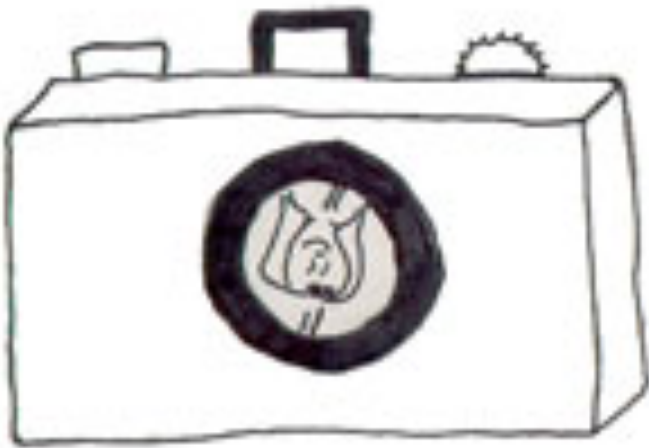
Begin with this and ask the students to get into groups and by using the diagram on pages 14-15, to discuss the following statement: **Your eyes are like a wonderful kind of camera. Why?**

Discussion points for the teacher:

The eyes see the world around you and send the images to the brain. The brain works out what the eyes are seeing. This happens from the moment that we open our eyes in the morning to when we close our eyes at night.

HOW A CAMERA WORKS

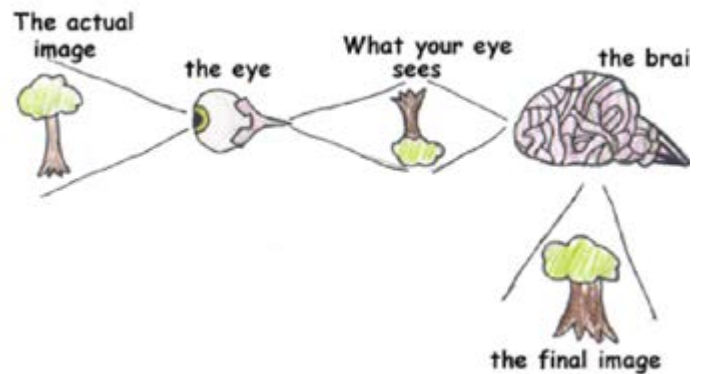
The light rays from an object that the camera is pointed at pass through the lens of the camera and show up on the screen of the camera (or smart phone) and get recorded in the computer in the camera or phone.



Do you notice something about this drawing? Yes, the picture that is recorded by the camera is upside down. (Of course, when you look at the picture on the phone or camera screen, it is not upside down.)

HOW YOUR EYES WORK

Your eye works in a similar way to a camera - light from something you are looking at passes through the lens of your eye and is picked up by special cells on the back of your eye (the retina).



Do you notice something about this drawing? Yes, the 'picture' that your eye 'takes' is upside down too! Why don't you see things upside down? Well, your eye sends the picture to the visual processing part of your brain, and your brain turns that picture the right way up so you see things the right way up.

INSIDE YOUR EYE

What are the parts of your eye and what do they do? Compare each of these with a camera.

<i>EYE</i>	<i>FUNCTION</i>	<i>CAMERA</i>	<i>FUNCTION</i>
<i>Iris</i>	A membrane which opens and closes pupil, controls the amount of light. It is the coloured part of the eye.	<i>The covering on the aperture</i>	Controls the amount of light that enters the camera
<i>Pupil</i>	This is the hole in the middle of the coloured iris. It lets light into the eye. It gets very small in bright light, and bigger in dull light.	<i>Aperture</i>	Can change in size in order to let the amount of light enter the camera
<i>Lens</i>	Helps to focus light onto the retina. It changes shape (getting thinner or thicker) to make sure that the 'picture' on the retina is as clear as possible.	<i>Camera Lens</i>	Focuses the image on the film. There are different lenses, depending on the magnification wanted by the photographer.
<i>Retina</i>	It is like a screen which picks up the image. The retina has two lots of cells called 'rods' and 'cones'. Rods can 'see' black and white. Cones can 'see' colours. They turn the picture into an electrical message for the brain.	<i>Film</i>	This is a light-sensitive area where the image of the object comes into focus.

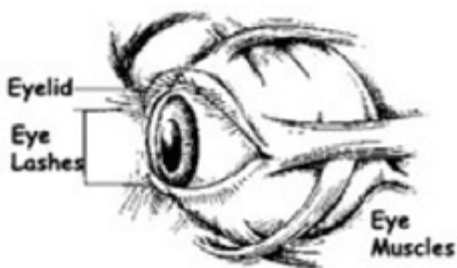
EXTENSION OF PHYSICAL FEATURES

Ask students to examine their eyes and examine the following physical features. Ask them what they think is the function of these features. Are they merely cosmetic?

INFORMATION FOR THE TEACHER

1. Eyelids

These protect the eyes. The eyelids can shut out light so that we can sleep. They will shut very fast if they feel something that is trying to get into the eye. Eyelids blink so they can keep a moist film over the cornea, thus keeping it healthy.



2. Eyelashes

Eyelashes can catch dust coming and they trap it as the eyelids close.

3. Eyebrows

Eyebrows also help to keep dust and sweat out of the eyes. The eyebrows of humans don't do much work, but many animals have thick and long eyebrow hairs that do help keep a lot of dust out of their eyes.

4. Tear glands

These are small glands inside the upper eye lid. Their job is to make tears to keep the surface of your eyeball clean and moist, and help protect your eye from damage. When we blink, the eyelids spread the tears over the surface of the eye. Small things that may be on the eye (like specks of dust) wash into the corner of the eye next to your nose. Sometimes tears flow over the lower eyelid but mostly the tears flow down a tiny tube at the edge of the lower eyelid, next to the nose. (If you look very carefully you can see a tiny dot that is the beginning of that tube). This tube carries the tears to the back of your nose, and this is why your nose 'runs' when you cry!



PENGUIN PUZZLES

LANGUAGE ARTS OUTCOME

Students will learn that active readers ask questions before they read and go back after reading to check that the text answered their questions.

SCIENCE OUTCOMES

Students will understand that the form of an animal and its body part determines its function.



CURRICULUM CONNECTION

This story uses penguins to connect to your life science syllabus. It teaches students that penguins are just one kind of organism that lives on Earth. Each organism has body parts that have evolved over time to help the organism survive in its natural habitat. These body parts have different functions.

This story also connects to the language arts syllabus, giving students practice in identifying main and supporting ideas. The ability to identify a main idea helps students establish a purpose for reading a nonfiction text.

BUILD BACKGROUND

Before reading, you can build background by having students go to this website: <https://seaworld.org/en/animal-info/animal-infobooks/penguin/>. It will give students basic information about penguins.

Then hold up the cover of **engage** magazine, which shows a penguin. Tell students that they will read about penguins. Then draw a KWL diagram similar to the one shown below.

K – What I know about penguins	W – What I want to know about penguins and how they use their senses	L – What I have learned about penguins

Direct students' attention to the left-hand column of the diagram, and have them list what they already know about penguins. Write their responses in

the column. After students have finished listing what they already know, turn their attention to the second column and have them list questions that they have about penguins. Explain to students that active readers ask questions before, during and after reading. By asking questions before reading, they can look for the answers as they read. You may need to prompt students with sample questions such as these:

1. How do penguins move on land?
2. How do penguins move in water?
3. How do penguins move in water?
4. What do penguins find in the water?
5. Are there different kinds of penguins?

After students have finished reading, have them return to the KWL diagram and complete the third column and list what they learned from the story. Compare their responses listed in the third column to the questions they listed in the second column. Check off the questions that were answered. Then ask students how they can find the answers to the unanswered questions, if any.

READY TO READ

After you have completed column 2 by listing their questions, have students turn to pages 16-17 and conduct the reading. You can conduct the reading through guided reading, small-group reading or independent reading, whichever works best for you and your students. Remind students that as they read they should look for the answers to the questions they listed in column 2 of the KWL diagram. Also tell them that as they read they may come up with additional questions, and they should ask them and look for the answers.

AFTER READING

ACTIVITY 1: Write a Paragraph

After all students have finished reading the story, split them into 6 groups. Tell them to imagine that they are scientists and they are going to Antarctica to study penguins. Like all scientists, they are going to use their five senses to observe the penguins that live there. Emperor penguins, king penguins, Adélie penguins, chinstrap penguins, macaroni penguins, and Gentoo penguins are the only kinds of penguins that live there. Assign one penguin to each group.

Have the groups research their assigned penguin and then write a paragraph describing what they see in Antarctica. Remind students that they are writing what they observe using their five senses, so they can use prompts like these: I see, I hear, I feel and/or touch, I taste, and I smell. After the groups have finished researching and discussing their penguins, have them write the paragraphs individually. They should use the first-person singular to write their paragraphs.

ACTIVITY 2 – Penguin Parts

Explain to students that a penguin's form and the form of its external body parts determines the function of each part. Direct students to open **engage** magazine to page 22. Have students investigate the body parts labeled in the diagram and then discuss those body parts that help the penguin swim in water.

On the board, construct a chart like the one below that students can use to discuss each body part. You can have students come up to the board individually to fill in each cell or call on students to suggest items for the cells and then fill them in yourself.

Body Part	Form	Function	Land or Water
Shape of the body	Tapered and streamlined	Swimming	Water
Tail	Short and wedge-shaped	Maintains streamlined shape for swimming	Water
Webbed feet	Set far back	Upright position for walking	Land
Wings	Look like flippers	Modified for swimming	Water
Eyes	Sharp on either side	Hunt fish	Water
Beak	Long	To eat fish	Land

Extension

Students can investigate the different penguins on pages 20 and 21 and check the body parts. You can also post on the board or wall photos of different species of penguins. Distribute sticky notes or cards and have students use them to label each penguin's body parts.

ACTIVITY 3 – Math Connection

Build comprehension by linking this activity to students' lives. Begin this part of the investigation by asking these questions:

- How many of you swim?
- What do you wear for swimming?
- What is the material made up of?
- Why don't you swim in a T-shirt, school uniform or jeans?
- How much time do we spend in the water?
- What happens to your bodies?

After concluding the above discussion, divide students into groups and ask them to discuss these questions: How much time do you think penguins spend in the water? How do you think penguins stay dry? After the groups have finished their discussions, bring the whole class together to continue the discussion. Guide the whole group discussion to include that the average amount of time a penguin spends on land varies by species. Some penguins spend up to 75%, or roughly three-quarters, of their time in the water. Ask them about how many hours in a day a penguin spends in the water (*18 hours*).

Have students make a two-column chart. Label the columns 'Activities' and 'Amount of Time'. Then have them list the activities they do in one day in the left column and the amount of time they spend doing each activity in the right column.

1. How many hours do you sleep?
2. If there are 24 hours in a day, how many hours are you awake?
3. Compare this with 75% of your waking hours.
4. Now can you imagine how long a penguin remains in the water? Indeed, it will be a challenge for penguins to stay dry!

ACTIVITY 4 – Stay Dry

Direct students to turn to page 23 of **engage** magazine and follow the instructions.

CRACK THE CODE - PENGUIN FACTS

Name: _____ Date: _____

Crack the Code to find the answer to the questions about penguins.

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26

1.) What do penguins eat?

11 18 9 12 12 , 19 17 21 9 4 , and 6 9 19 8

2.) What is the smallest species of penguin called?

12 9 20 20 12 5 2 12 21 5 16 5 14 7 21 9 14

3.) How fast can some penguins swim?

6 9 6 20 5 5 14 13 16 8

4.) How many different species of penguins are there?

14 9 14 5 20 5 5 14



Name: _____

RI
17



Penguins

Directions: Draw and write about how you used the illustrations in the text.

I read

I saw

I Learned

MEET THE ICEMAN

LANGUAGE ARTS OUTCOME

Students will continue to develop their skills in asking questions of nonfiction or informational text

MATH OUTCOME

Students will learn about geometric shapes.

SCIENCE OUTCOME

Students will learn that making observations is essential to the scientific process.



BUILD BACKGROUND

Begin the lesson by using a large map of India to show where Ladakh is located. Explain to students that the word 'Ladakh' is made up of two words – 'La' meaning mountain pass and 'Dak' meaning country. Ladakh is a cold desert in India, lying in the great Himalayas, on the eastern side of Jammu and Kashmir.

Why is Ladakh called a cold desert?

- Due to the high altitude, it can be freezing cold and dry in Ladakh.
- The air is so thin that the sun's heat can be felt intensely. In summer the temperature during the day can be about 21 degrees, and at night the temperature falls to –30 degrees. In winter the temperature is usually about –40 degrees.
- The rainfall in this region is as low as 10 cm annually. This is because it lies in the rain shadow of the Himalayas.

Hence, we can conclude that the area experiences freezing winds and burning sunlight, and is therefore called a cold desert.

READY TO READ

Hand out copies of **engage** magazine and have students turn to the story 'Meet the Iceman' on pages 22-29. Direct students to preview the text and write down questions they would like answered as they read. Remind them that good readers ask questions and then go back to see if the text answers their questions. Tell them that they can make their own KWL diagram to do this. Have the students do this independently. This is part of a gradual release model. In 'Penguin Puzzles,' you walked students through how to make a

KWL diagram. In this story, you can assist students in making their own KWL diagrams, but you should not make a master diagram for the whole class. This will help students automatically start asking questions and constructing their own KWL diagrams each time they read nonfiction or informational text.

Conduct the reading session with students using guided reading, small-group reading, or independent reading.

AFTER READING

ACTIVITY 1: Scientific Method

After all students have finished reading, show them this video: <https://www.youtube.com/watch?v=I7bH8A2EyxI> It will help them understand how Wangchuk built his ice stupas. It will also help them develop 21st-century literacy skills by integrating text and video.

Explain to students that scientists use a process called the scientific method. By following this process, scientists can develop explanations for natural phenomena and solve problems. Making observations is one part of the scientific method.

Read the poem *The Scientific Method* (overleaf). Then ask students to discuss whether Wangchuk used it to solve the problem in Ladakh.

THE SCIENTIFIC METHOD

How do scientists do what they do?

Well, **YOU** know because you're a scientist, too!

Observation is an important part--
in fact it's the part at the very start.

For it's observation that causes you to wonder why
earthworms do what they do and clouds form in the sky.

Your **hypothesis** is a "best guess" based on what you know
about how things work--now you're ready to go!

Experimentation lets you test the hypothesis you've made--
to see if your best guess can make the grade.

And because **variation** is found in nature everywhere,
repeated trials should be done, and done with care.

And don't forget to decide what **variables** you'll test.

You change the **independent variables**, but not the rest.

Recording your **data** is very important, too;

so you can **analyze** the results and others can repeat what you
do.

When you've summarized your results and your experiment is
done,

you'll have more information about nature and you'll have had
some fun.

So, now you know that the **scientific method** is really cool,
and that scientists don't just measure--**they RULE!**



The University of Georgia

Savannah River Ecology Laboratory

Write the following diagram on the board, including the labels and the right column. Ask students to use the concepts from the poem to fill in the second column. Then use the story from engage magazine to complete the third column. Refer to the diagram below to check responses.

CONCEPT	MEANING	WHAT DID SONAM WANGCHUK DO?
Observation	Scientists use their senses in order to gather information, which may be simply seen or even measured	He unexpectedly saw a pile of ice on a warm day.
Hypothesis	A statement, usually in the form of a "what if" statement to enable scientists to make an initial prediction.	It may be possible to store ice under certain conditions even in warm weather.
Experimentation	A systematic investigation	Used pipes to bring water closer to the farms and allow it to freeze by spraying it into cold air.
Variation	Nature is not consistent, and there may be natural differences between experiments.	Do you think this can change within different farms in Ladakh? Which factors would influence this?
Repeated Trials	More than one investigation or experiment under the same conditions	Research to find out how many trials he conducted.
Variable	The quantity that can change and therefore alter the results	He changed the height of the pipe, and also investigated which shape to use, based on its surface area and volume.
Data	The evidence gathered from the experiment.	In each ice stupa that he created, Sonam Wangchuk measured the amount of water for the farms and kept a record.
Analyze	Look at the data and come up with an inference for the result of the experiment.	Sonam Wangchuk analyzed all his data and each time altered his experiment to obtain the optimum amount of water for the farms.

ACTIVITY 2 – Geometric Shapes

Direct students to turn to page 26, and then look at the geometric shapes at the bottom of the page. Ask them to carefully look at each shape and describe it. THEN ASK: Why did Sonam Wangchuk choose the conical shape? Have the students do an inquiry: Which of these shapes do you think has the maximum surface area and the maximum volume? This inquiry will work best if the students can understand it visually rather than through a subjective discussion. After discussing the shapes, have students turn to page 29 and tell them that they will do the activity on the page.

Before conducting the activity, make sure that students understand certain mathematical terms:

1. **Surface area** is the amount of space a face of a geometric shape take up. A cube has six faces, four sides, a top and a bottom. You can find the total surface area of a cube by adding the surface area of each face.

These two videos explain surface area: <https://www.youtube.com/watch?v=xCdXURXMdFY>

<https://www.youtube.com/watch?v=ZJ-VMcbLTaU>
They feature teachers explaining surface area and provide good background for you.

2. **Volume** is the amount of space a geometric shape takes up. You can find out a shape's volume by placing it in a measuring cup of water. When the shape is put in the water, the water level rises. The difference between the water levels is the shape's volume. You can also use a mathematical formula to calculate a shapes volume.

You can use this video to explain volume: <https://www.youtube.com/watch?v=qJwecTgce6c>.

After explaining surface area and volume, have students do the activity. You may want to conduct this activity as a whole-group project that you lead. You should model the thought process in each step in the activity. At the end of the activity, ask students to discuss why the cone is the best shape to hold ice cream they are eating.