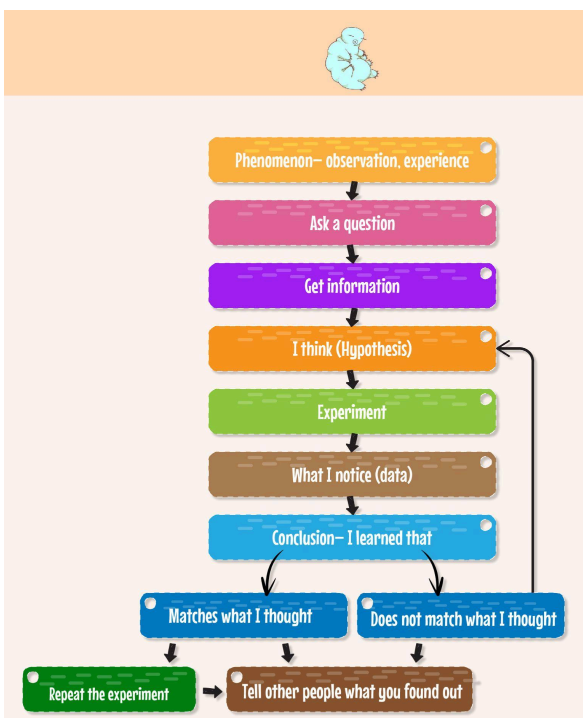
Integrating Literacy and Science Practice Skills via Investigating the Effect of "Cold" (low thermal energy) Phenomenon in Dr. Rosie Helps the Animals (K,1,2) Teacher Lesson Plan	
Lesson Summary	This two-day lesson is based on the book *Dr. Rosie Helps the Animals.* The first day consists of reading and processing the story, focusing on the various remedies Rosie uses. On the second day, students employ science practice skills while investigating the effect of cold phenomena. This experience gives students a foundational understanding of the particle motion theory. **Day 1: Literacy Skills (Common Core)** **Kindergarten**: CCSSELA-Literacy.SLK.1 Participate in collaborative conversations with diverse partners about *kindergarten topics and texts* with peers and adults in small and larger groups. **Grade 1**: CCSS.ELA-Literacy.SL.1.1 Participate in collaborative conversations with diverse partners about *grade 1 topics and texts* with peers and adults in small and larger groups. **Grade 2**: CCSS.ELA-Literacy.SL.2.1 Participate in collaborative conversations with diverse partners about *grade 2 topics and texts* with peers and adults in small and larger groups. **Grades 1- 2** R.I.1.1. Ask and answer questions about key details in a text. (1-LS1-2), (1-LS3-1) **Day 1: Cultural and Linguistic Practices** Note: *Dr. Rosie's* story provides several examples of natural remedies. This provides an authentic opportunity for students to share remedies they have learned about or experienced from their culture. From: Cultural and Linguistic Practices ★ Connect the book's content to your students' cultural and linguistic backgrounds. ★ Ask students to connect to the remedies in the story by relating them to their cultural experiences. ★ Ask relevant and inclusive questions that connect to all students from various backgrounds **Day 2: Standards-Aligned Science Practice Skills** **Kindergarten** **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) **First Grade**

	Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions **Second Grade** **Developing and Using Models** Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. • Develop a simple model based on evidence to represent a proposed object or tool. (2-LS2-2) **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-LS2-1)
Phenomenon-based learning is included in the Next Generation Science Standards (NGSS)	

Day 1: Read and Process		
Grade Levels: K-2	**Topic:** *Dr. Rosie Helps the Animals* (Read and process)	**Materials** ● *Dr. Rosie Helps the Animals* Book or Reading by Rozillia ● Remedies Phenomena Pupil Page-cold

Lesson Objectives/Learning Goals:

★ Students will be introduced to veterinary medicine as a STEM profession through an engaging informational fiction story

★ Students will be able to identify the remedies Rosie used for each affliction.

★ Students will be able to compare and contrast Rosie's remedies with their own experiences.

Time	Activity	Teacher Actions	Student Actions
________ minutes	Introduction to the Dr. Rosie story	**Questions**: *Have you ever been sick? What helped you get better?* Today, you're going to meet a young person who helps animals get better! Listen to find out who Dr. Rosie meets and how she helps each animal.	Reply to the questions
________ minutes	Story Reading and Scaffolded note taking	Give each student a copy of Remedies Phenomena Pupil Page. As you read the story, pause with each remedy. Ask kids if they have had that affliction and what remedies have they used at home. Ask students to match the affliction and remedy on the pupil page.	Listen to the story and match the animal with the remedy

Day 2: The effect of "cold" (low heat)
phenomenon-based guided-inquiry science lesson

Grades levels: K-2	**Topic:** Effect of Cold Phenomenon	**Materials:** • (per group or as a demo) balloon, string, marker, scissors, freezer or ice chest, ruler • Effect of cold phenomena pupil pages (Level 1, 2, and/or 3 according to student needs)

Lesson Objectives/Learning Goals

- Students will utilize a variety of science practices to investigate the effect of cold on a substance (air)
- Students will make connections between how cold affects the size of a balloon and how a compress filled with ice affects a swollen bump*

*** It is important to let kids know that when ice reduces swelling, it is due to a physiological response to cold. Ice causes blood vessels to constrict or become more narrow. When this happens, less blood and the fluid it brings reaches the injured area. This reduces swelling.**

To the teacher: *This investigation, using a balloon, provides a foundational understanding of the particle motion theory, a higher-grade NGSS content standard. Content that is both general and specific to this guided inquiry is provided below.*

Science Content Background for this Lesson

(for more on this fascinating physical science phenomenon, read Deeper Dive at the end of this lesson)

The ***particle motion theory*** states that everything is made of tiny particles (atoms and molecules). The particles are attracted to each other. The mutual forces of attraction are different for different substances. The particles are constantly moving with what is called "kinetic energy." Adding energy (heating them up) makes the particles move more and get farther apart from each other which makes the entire substance that they are made of get bigger in size. This is called ***thermal expansion***. A marshmallow heated in a microwave is an example of thermal expansion. Taking heat away ("cooling") makes the particles slow down and get closer together, making the entire substance smaller. This is called ***thermal contraction***. For example, once the microwave is turned off, the marshmallow gets smaller in size.

[Thermal Contraction and Expansion]
[Expansion and Contraction of Matter: Particle Motion Theory]

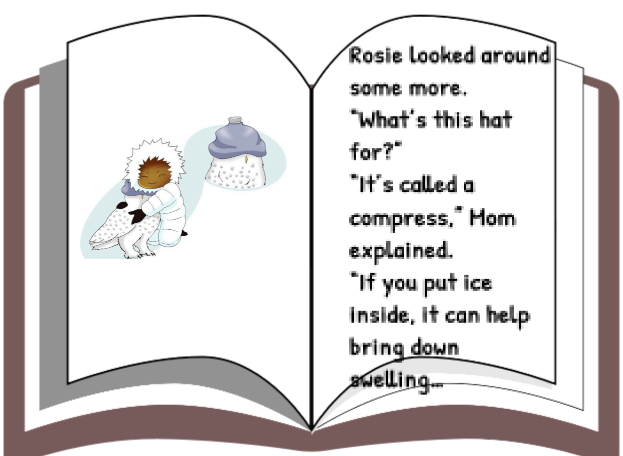
In this investigation, students will test the effect of cold (reduced thermal energy) on the size of a balloon. The balloon is a model of a bump on the head.

Background Relating to this Investigation

When you blow up a balloon, air particles (even though you cannot see them) from your lungs go into the balloon. The particles have energy and are hitting each other and the inside of the balloon, sort of like bumper cars. If the balloon is heated up, the air particles gain more energy and move faster and farther apart. They put more pressure on the inside of the balloon and the entire balloon gets bigger. Likewise, if the balloon is put in a freezer, the air particles lose energy, move more slowly, and get closer together. They put less pressure on the inside of the balloon, and the entire balloon gets smaller.

How does this relate to a compress with ice in it? Icing a swollen bump is effective because the cold constricts blood vessels and decreases circulation to the area so there is less buildup of fluid at the site.

Excerpt from Dr. Rosie Helps the Animals



Vocabulary

Swelling- being puffy. When something is swollen it is bigger than usual.

Compress- something that can hold hot water or ice. It is used to help treat pain or swelling.

To the teacher: This lesson, using a balloon, provides a foundational understanding of particle motion theory, a higher-grade NGSS content standard. Note that the balloon serves as a model for a swollen bump. When ice reduces swelling, it is a physiological response to cold. It is not the result of body particles getting closer together, as in the case of the shrinking balloon.

Rosie's mom claims that ice can bring down swelling. This is a guided inquiry lesson to test the effect of cold on the size of an object (a balloon)

Before Starting

1. What did Rosie's mom say that ice would do to swelling? If you pretend that a balloon is like a head bump, what do you think will happen to the size of a balloon if it is put in a freezer? Will it stay the same? Will it get larger? Will it get smaller?
2. How can you figure out if the size of a balloon changes when it gets cold?

Experiment:

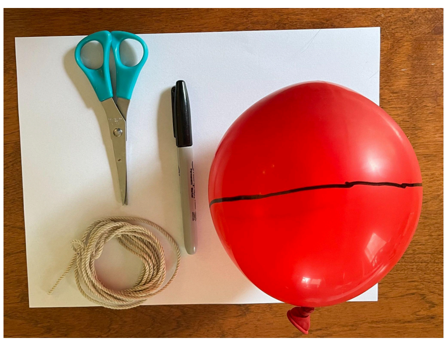
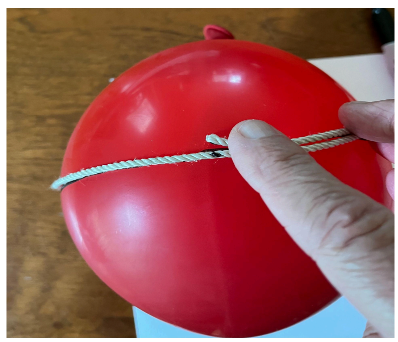
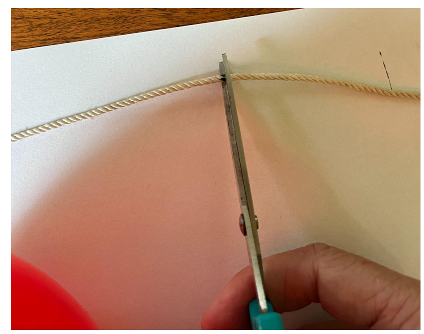
The effect of "cold" on the size of a balloon

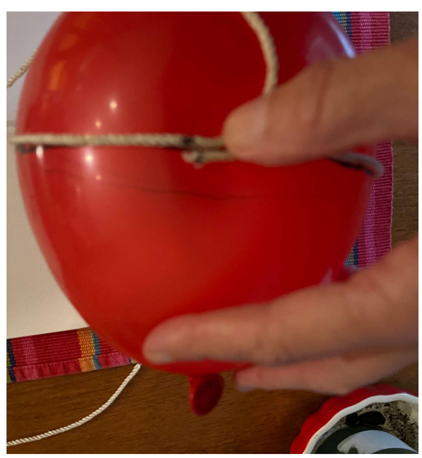
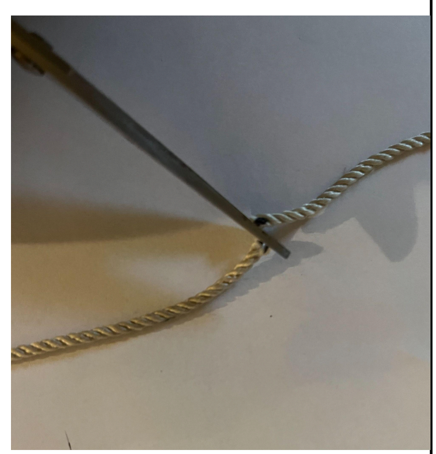
Materials for the Experiment:

- Balloon (1 for a demo or more if kids are testing)
- Sharpie(s)
- String
- Ruler
- Freezer or cooler with ice
- Effect of cold pupil page

Directions:

1. Distribute Effect of Cold Pupil Page- have students complete steps up to and including the hypothesis
2. Blow up and tie off a balloon.
3. Use a Sharpie to draw a line around the circumference of the balloon. It does not have to be the exact circumference.
4. Lie a piece of string along the line to determine the circumference. Record.
5. Put the balloon in a very cold area (freezer, cooler with ice) for 15-30 minutes.
6. Remove from the cold area and quickly measure the circumference using another piece of string. Record. Compare or measure the lengths of the two strings.
7. Have students complete the rest of the Effect of Cold Pupil page.

		The length of the string before it was in the freezer: 17 6/8 inches The length of the string after the balloon was in the freezer: 16 ⅞ inches

Making Connections:

1. What happened to the size of the balloon when it was cold?
2. If the balloon is like a swollen bump, what does ice do to the size of the bump?

Extension

To the teacher: You can do the following as a demo or, depending on the age of your students, they can set the experiment up themselves or in groups.

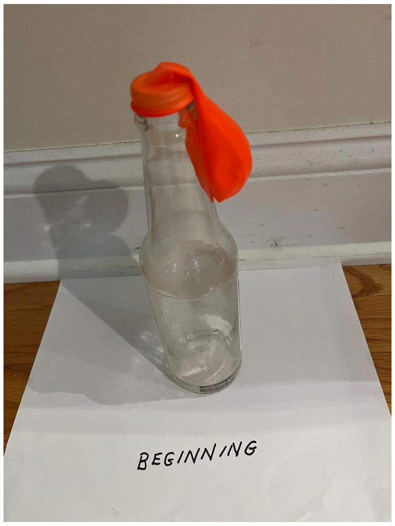
Materials

- Balloon
- empty glass bottle
- hot water
- ice water

Procedure

1. Put a balloon over the top of an empty glass bottle. Ask students to predict what will happen to the size of the balloon if the bottle is put in hot water.
2. Put the bottom of the bottle in hot water. Observe.
3. Have students discuss what they observed and why they think it happened.
4. Have students predict what will happen to the size of the balloon if the bottle is put in ice water.

5. Put the bottom of the bottle in ice water. Observe.
6. Have students discuss what they observed and why they think it happened.



Safety Concerns: There are no particular safety concerns with this activity other than precautions one would use with a balloon or a string.

Safety Concerns for the Extension Activity-The hot water does not have to be any hotter than a hot shower. It should not be hot enough to cause any injury.

Deeper Dive Science Content:

https://www.youtube.com/watch_popup?v=-zfV0tQl9MI

A sand mandala is made of individual grains of sand.

Similarly, the **particle motion theory** of matter states that everything (even a grain of sand) is made of tiny particles that you cannot see (atoms, molecules, etc.). These particles are constantly moving (they have kinetic energy) and have forces of attraction between them. For every particular kind of material, the particles in a solid form of that material have low energy (relative to the liquid or gas form of that same substance) and are vibrating in place. The particles do not have enough energy to overcome the forces of attraction between them so they are locked in a rigid shape. We call this state a **solid**. If you add energy to the particles (heat them up), they vibrate more and begin to get farther apart from each other. We call this the ***thermal expansion of a solid.*** If you continue to give the particles energy (heat them up), they eventually have enough energy and move far enough apart that they are able to partially overcome the forces of attraction holding them in place. When this happens, the particles are no longer held in a rigid shape and they begin to flow around each other. We call this state a **liquid**. If you continue to add energy, the particles in a liquid move more and get farther apart from each other. We call this the ***thermal expansion of a liquid.*** (The "old-fashioned" mercury or alcohol thermometers work because of thermal expansion.) If you continue to add energy to the particles of a liquid they will have enough energy and move far enough apart to completely overcome their forces of attraction. The particles freely move around. We call this state a **gas**. Adding more energy makes the particles in a gas state move faster and get farther apart. We call this the ***thermal expansion of a gas***. If you continue to add energy to a gas, it will become a state called **plasma**.

If you remove energy (the particles get "colder") from a gas, the particles lose energy and get closer together. This is the ***thermal contraction of a gas.*** Eventually, the particles will come close enough to each other that the forces of attraction will begin to hold them loosely in place and they flow around each other. We call this the liquid state. An example of this is condensation on the mirror in a bathroom. If you continue to remove energy from the liquid particles, they move more slowly and get closer together. We call this the ***thermal contraction of a liquid.*** Eventually, when enough energy is removed, the liquid particles get so close together that they are not able to overcome their mutual forces of attraction and they are then held in a rigid structure. We call this the solid state. Removing more energy creates the ***thermal contraction of a solid***. Thermal expansion joints are important in bridge construction. They allow the concrete to expand and contract without cracking. Each kind of material has its own thermal contraction and expansion rates. These are important in everyday life and in building and design. One can remove a metal lid from a glass jar after running it under hot water because the metal and glass have different rates of thermal expansion.

Source: https://siamagazin.com

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