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ACTIVITY : 1 HR 40 MINS

Spreading Germs

Students brainstorm and discuss how we can share germs and illnesses with others. They engage in a hands-on demonstration that shows how far a sneeze can carry germs and consider how different everyday activities help or prevent germs from spreading. Finally, students generate questions and connections to the unit driving question.

GRADES

3, 4

SUBJECTS

Biology, Health

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OVERVIEW

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For the complete activity with media resources, visit:
http://www.nationalgeographic.org/activity/spreading-germs/

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DIRECTIONS

This activity is part of The Truth About Germs unit.

1. Lead a class discussion to have students share ideas about how germs spread and brainstorm how germs commonly enter human bodies.

- Connect to students' previous experiences and learning from the *Sick Days* and *Germs All around Us* activities by asking:
    - *When you got sick from a germ, where do you think that germ came from?* (Students' responses may include: Items in my environment—door handle, sink faucet, etc., other people, or the air.)
        - It may be helpful to point to the class Question Quadrant chart that helps to anchor students' learning and ideas in this unit.
        - Accept all student ideas, in the interest of building on their initial understanding.
            - Highlight that the *Germs All around Us* activity focused on environmental factors and this activity will focus on how germs spread between people.
- Lead a class brainstorm to gather students' ideas about how and where germs enter our bodies. Help students make connections between their responses to the opening question, as well as concepts from the *Germs All around Us* activity, such as:
    - Ideas from the book *Tiny: The Invisible World of Microbes* (7:25) that germs can get into bodies through our mouths, cuts, or sometimes even insect bites.
- Accept all student ideas, emphasizing that for viruses such as the common cold, influenza, and the coronavirus, the nose and mouth are the main pathways for entering our bodies.
- Build on this idea to elicit from students how the nose and mouth are also key pathways for viruses to leave our bodies, through coughs and sneezes.

2. Lead a class demonstration to simulate how sneezing helps germs travel between people.

- Building on students' ideas from the previous step, explain that now they will demonstrate one important way that germs travel if we don't cover our coughs and sneezes.
- Show a spray bottle filled with water and food coloring, then prompt students' ideas about the demonstration by asking:

- *How will this spray bottle model what happens during a sneeze?* (The spray bottle represents a person's nose and mouth, and the water represents germ-filled droplets that get forced out in a sneeze.)

- Before spraying (see Setup):
    - Put down white butcher paper or another light-colored surface, so students can see how far the water droplets travel.
    - Prompt students to predict how far the droplets will travel. Students can mark or add tape to show their predictions.

- Simulate a sneeze with the spray bottle, repeating a few different times.
    - Have a volunteer help measure the maximum length the droplets travel, using a meter stick, yard stick, measuring tape, or the previously-noted increments that you added to the paper or surface (see Setup). Record the data in a class chart.
    - Invite students to see how close they were in their predictions.

- Then challenge students to determine how to make the sneeze droplets travel farther, and, conversely, brainstorm ways to keep droplets from traveling as a way to reduce the spread of germs.
    - Determine as a class which two or three ways to test, and repeat the predictions, simulation, and measurements.
    - Record the data in the class chart and have students create a line plot to represent the findings.
        - Direct students to mark off the horizontal scale of the line plot in the unit fractions that are relevant to fourth grade math standards (see Standards). If working with third grade math standards, see Modifications.

- Lead a class discussion to debrief the simulations, with students using their line plots to support their understanding. Emphasize that droplets likely went a lot further than students predicted.
    - Support data literacy and help students make connections between the simulation and real sneezes by describing the experiment and showing images from the article, *See how a sneeze can launch germs much farther than 6 feet*. Point out the finding in the article that "a fine mist of mucus and saliva can burst from a person's mouth at nearly 160 kilometers per hour (100 miles per hour) and travel as far as 9 meters (27 feet)."

- Reflect on how measures such as covering the spray bottle helped to keep the droplets from traveling as far, and how we replicate this in real life by wearing masks or other preventative measures, to segue to the next step.

3. Facilitate a card sort about different activities that help or prevent germs from spreading.

- Introduce the card sort. Explain that students will consider how different everyday activities help or prevent germs from spreading, so they can apply these ideas to their hypotheses about why germs make us sick more often during the winter.
- Distribute the *Spreading Germs Card Sort* handout and scissors to pairs or small groups of students. Review the directions and circulate as students work together, being sure to:
    - Attend to students' thinking and ideas in preparation for the next step that relates their learning to the unit driving question.
    - Prompt students to explain their reasoning, especially for activities that they identify as "it depends" in terms of spreading germs.
        - Check that students question whether the activity is done in close or far proximity from other people. To relate to the unit driving question that will be revisited formally in the next step, they may also connect that some activities (playing in the snow versus swimming at the pool) are more seasonal or weather dependent.
    - Encourage creative ideas for other activities that help prevent germs from spreading.
- Invite students to share out their categories or circulate to see their peers' categorization and activity ideas.
- Ask students to find common themes across the categories, emphasizing how activities that help germs spread involve people being in close contact versus activities that keep germs from spreading involve people being distant from each other. Talk about how the climate/weather/season influences these activities and favor spread of germs

4. Connect students' learning to the unit driving question by revisiting their initial hypotheses about why germs make us sick more often during the winter.

- Remind students of the unit driving question: Why do germs make us sick more often during the winter?

- Have students access their individual *Question Quadrant* handout from the *Sick Days* activity.
- Ask students to generate any new questions they have; especially for this activity, they may have new questions for the People quadrant, such as:

    - What are other ways people help or keep germs from spreading?
    - What else can we do to keep from getting sick?
    - Are some of these activities easier to do or avoid than others?

- Next, have students revisit their initial hypotheses related to the unit driving question. To learn more about this practice, see Tips.

    - Direct them to add ideas from this activity (and the *Germs All around Us* activity) on sticky notes or in a different color than their original hypotheses.

- Prompt students to consider if the new ideas support or counter their original hypotheses about why germs make us sick more often in the winter.

    - Students may respond: I originally thought that germs made us sick more often in the winter because they use our bodies to keep warm in the cold temperatures. Now I think the fact that people are together more often in the winter may play a role, which is different than my original idea.
    - If their thinking has changed, have students write their new hypothesis on their *Question Quadrant* handout.

- Debrief and synthesize student thinking by returning to the class Question Quadrant chart and revisiting the class' initial hypotheses.

    - Discuss each quadrant sequentially, starting with Environment and then People.
    - Document students' new thinking with sticky notes or a different color than their initial hypotheses.

- Explain that in the next activity, *Bad Germs: Keep Out!*, students will generate new ideas for the Germs and People quadrants as they explore more about how our bodies try to keep germs out.

5. Advance students' work on the unit project by modeling how to write trivia questions for the Germology Game Show.

- Redistribute students' individual *Trivia Question Builder* handouts. Explain that you will model how to use the ideas in this activity to create trivia questions and evidence-based answers, in preparation for students doing so on their own in following activities.
- Ask for volunteers to share: *What new facts or ideas from this activity do you want to share with your community through the Germology Game Show?*
- Record students' facts and ideas in a public document, such as on the class whiteboard or chart paper.
- Select one fact or idea to model how to write a trivia question and evidence-based answer. Choose a fact/idea that is especially common among students, relies on a key piece of evidence, or would be of interest to adults and kids in their community.
- Follow the steps on the *Trivia Question Builder* handout as you record your process of developing a question, answer choices, and scientific explanation for each answer choice.

    - Talk through your thinking process, emphasizing how to communicate about cause-and-effect relationships between different factors related to Germs, People, Environment, or Something Else.
    - Invite students' ideas to model the kind of collaborative process students should use when developing questions with different partners and group members throughout the unit.
    - If relevant, explain how supporting evidence for the answer choices could come from ideas or visuals from the brainstorm in Step 1, the demonstration and data in Step 2, or the card sort in Step 3.

        - For example, you may say: *We decided people in our community really need to know that sneezes carry germs much farther than they think. I think this would work best as a fill-in-the-blank question. The question could be, "Sneeze droplets can carry germs at the speed of _____ miles per hour and travel as far as _____ feet." Answer choices could include "1, 10, 100, or 1000 miles per hour" and "7, 17, 27, or 37 feet," with the correct answer being: nearly a hundred miles an hour and travel as far as 27 feet. For each answer choice, we could include the graphs of sneeze data and our measurements with our interpretation of what it means.*

    - Prompt students to review the question-and-answer choices that you wrote and determine if it will make sense and be interesting to someone in the community. If needed, have students help to revise the language or content to make it more accessible.
    - Have students record the question, answer choices, and explanations on their handout, as the first question in the *Spreading Germs* Question Set.

    - Save the recorded process to refer to as students write their own trivia questions in subsequent activities.

- Finally, lead the class in collaboratively writing a second question for the *Spreading Germs* Question Set, based on another interesting idea that students determine community members will find interesting or need to know.

Informal Assessment

Use students' ideas about how and where germs enter our bodies, as well as their ideas from the card sort of activities that help or prevent germs from spreading, to assess their prior knowledge and experiences about the immune system, which can guide instruction in the next activity in the unit. Additionally, use students' questions in Step 4 to assess their abilities to ask questions that demonstrate cause-and-effect relationships between people, germs, and getting sick.

OBJECTIVES

Subjects & Disciplines

Biology

- Health

Learning Objectives

Students will:

- Use a simulated model of a sneeze to demonstrate how far germ droplets can travel.
- Create an accurate line plot of measurement data using a horizontal scale marked off in fractions of units.
- Identify how different everyday activities help or prevent germs from spreading.
- Generate new questions and hypotheses about why germs make us sick more often during the winter.
- Collaborate as a class to create trivia questions and evidence-based answers about how germs spread.

Teaching Approach

- Project-based learning

Teaching Methods

- Brainstorming
- Demonstrations
- Discussions

Skills Summary

This activity targets the following skills:

National Standards, Principles, and Practices

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

• **CCSS.ELA-LITERACY.SL.3.1:**
Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.
• **CCSS.ELA-LITERACY.SL.4.1:**
Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.

NEXT GENERATION SCIENCE STANDARDS

• **Crosscutting Concept 2:**
Cause and Effect
• **Crosscutting Concept 3:**
Scale, proportion, and quantity
• **Science and Engineering Practice 2:**
Developing and using models

• **Science and Engineering Practice 4:**
Analyzing and interpreting data
• **Science and Engineering Practice 5:**
Using mathematics and computational thinking
• **Science and Engineering Practice 6:**
Constructing explanations and designing solutions
• **Science and Engineering Practice 8:**
Obtaining, evaluating, and communicating information.

Preparation

What You'll Need

MATERIALS YOU PROVIDE

- Food coloring
- Markers
- Meter sticks or rulers
- 8-10 feet White butcher paper or another light-colored surface
- Masking tape
- Spray bottle
- Scissors

PHYSICAL SPACE

- Classroom

SETUP

Determine ahead of time if the sneeze simulation in Step 2 will be demonstrated for the whole class or in small groups, and prepare materials accordingly. Put down white or light-colored butcher paper or another surface that will show where droplets land. Have tape measures, meter sticks or yard sticks, or rulers on hand for measuring, depending on what math standards you are working with (see Standards). Alternatively, consider pre-measuring and marking distance from the "sneeze" start, in both centimeters and meters or inches and feet.

GROUPING

- Large-group instruction

- Small-group learning

ACCESSIBILITY NOTES

Students with diverse learning needs may benefit from extra time and collaborative support during Steps 3 and 4 as they engage in the card sort and connect what they have learned to the unit driving question.

BACKGROUND & VOCABULARY

Background Information

The COVID-19 pandemic brought a new level of attention to slowing the spread of germs through simple, everyday measures, such as wearing a mask, keeping distance between people, washing hands, covering coughs and sneezes, and cleaning commonly used items/surfaces. Sneezing is a first-line immune response intended to expel microbes or particles that enter the nose. Sneezing can propel droplets more than 6 meters (20 feet) at speeds up to 160 kilometers per hours (100 miles per hour), making it a primary way to spread germs between people.

The types of preventive measures discussed in this activity serve to minimize all types of infectious transmission between people, as also made evident during the COVID-19 pandemic in which rates of other respiratory illnesses plummeted. For example, a drastic decrease in flu cases has been reported during the pandemic time. Although the benefits of activities that minimize the spread of germs are evident through these kinds of statistics and are directly discussed in this activity, be sure to also be sensitive to students' experiences in terms of the challenging and traumatic impacts of having lived through a pandemic. Talk about adapting to online classes full-time, avoiding touching people including handshakes or hugs, having to use hand sanitizer, or washing hands often. How will students think about bacteria moving forward as activities/businesses slowly reopen?

Prior Knowledge

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Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
environment	*noun*	conditions that surround and influence an organism or community.
germ	*noun*	disease-producing microbe.
hypothesis	*noun*	statement or suggestion that explains certain questions about certain facts. A hypothesis is tested to determine if it is accurate.
model	*noun*	image or impression of an object used to represent the object or system.
simulation	*noun*	copy or reenactment.
virus	*noun*	pathogenic agent that lives and multiplies in a living cell.

For Further Exploration

Video

- SciShow Kids: All About Sneezes!
- MythBusters: Art of the Sneeze
- MythBusters: How a Virus Spreads So Easily