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ACTIVITY : 1 HR 15 MINS

Sick Solutions

Students make observations of high-touch areas, and then learn about the next step of the engineering design process—imagine possible solutions. Students pick a context or specific problem to solve. Students explore existing examples of designs or products. They brainstorm and record as many solutions as possible in their groups.

GRADES

1, 2

SUBJECTS

Biology, Health, Engineering

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OVERVIEW

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

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DIRECTIONS

This activity is part of the *Germ Problem-Solvers: Using Engineering to Develop Solutions* unit.

1. Lead students in observing high-touch areas so they can use data to inform their solutions.

- Provide students with a list of the contexts and problems discussed in the *Invisible Villains* activity, compiled from their *Spreading Germs Snapshots* handout. Have students pick a context or specific problem to solve. Organize students in project groups of three or four based on the problem or context they are interested in working on. Students will work in these teams to design a collaborative solution as the final product for the unit project.
    - Contexts could include: times of day, situations, or locations when germs are spread (e.g., riding the bus, lunchtime, recess, etc.)
- Problems could be specific issues in their context that need to be solved (i.e., the restrooms are out of soap, friends don't cover their coughs, friends share drinks at lunch, some people come to school when they are sick, etc.).
- Point students to the preliminary predictions they made about high-touch, germy areas after watching the video *Growing Bacteria* (2:11) by Sick Science!, in the activity *Getting to Know Germs.*
- Let students know that in this lesson, they will carry out some observations of those high-touch areas to see if their predictions are correct.
- Using their list of high-touch areas as a starting point, narrow the areas down to three or four locations that could be observed easily in five to ten minutes.
    - For example, a water fountain, the doorknob to the restroom, a highly-trafficked railing on the way to lunch or activity, your desk, etc.
    - Distribute the *Observing Germy Places* handout and model for students how to use tally marks to keep track of how often a surface is touched in the determined time frame.
    - Observe each location as a class or, if you have other adults to help, divide the class into three or four groups to carry out the observations. Regroup to share and discuss the class findings; direct students to record the findings from other groups on their data table and determine which location was touched the most.
    - Assist students as they write a claim on their handout. Explain to students that a *claim* is a statement you make based on evidence that answers a question. Share the question we are answering with this activity: *Which area in our school is the most germy?*

- Have students work in their project groups to use evidence from their observation to make a claim about which location is the most "germy" and what behaviors cause that location to have a lot of germs. (Sample student response: For our solution, we will focus on the walls along the hallway to the lunchroom. We observed 11 out of 19 children running their hands along the walls. They were on their way to lunch. This makes this location very germy. Now they are eating with germy hands! They could get sick!)

2. Introduce the next step of the engineering design process—imagine possible solutions—as well as example solutions to prepare students for brainstorming.

- Remind students of the driving question of the lesson (How do we keep germs from spreading?), the final product of the unit project (to design a tool or product that helps keep germs from spreading), and the problem(s) they are trying to solve.
- Introduce the next step of the engineering design process using the *Engineering Design Process Cycle Graphic*—imagine possible solutions.
- Before students begin brainstorming, show existing examples of designs or products that are intended to slow the spread of germs that make us sick. Some examples include:

    - Sink-urinal
    - Door handle for your feet: *FootPull*, *Toepener*, or *StepNpull*
    - Cleaning the most highly-trafficked/germy spots in the classroom
    - Doing a better job of washing hands
    - Signage to remind students to keep hands off of faces, stop the spread of germs, wash hands, etc.

3. Lead students in brainstorming solutions to germ-spreading problems they identified in previous activities so that they can make progress on their final product.

- Introduce guidelines for collaborative brainstorming, such as:

    - Everyone gets a turn to share
    - Record all ideas
    - Build off of each other's ideas
    - Encourage wild ideas and spontaneity
    - There are no wrong ideas
    - No talking over each other
    - Respect each other's ideas
    - Stay focused on the topic and keep the problem in mind

    - Develop as many ideas as you can

- Distribute and introduce the *Brainstorming Solutions* handout they will use to collect their ideas.

    - Be sure that students also have access to their *Getting Rid of Gross Germs Research Notes* handout and *Spreading Germs Snapshots* handout.

- Remind students of the driving question for the unit and of the limits to solutions they discussed in the *Getting Rid of Gross Germs* activity and recorded in the *Getting Rid of Gross Germs Research Notes* handout.
- Ask students to identify the specifics about the problem they are solving (who/what/where/when/why) on their *Brainstorming Solutions* handout.
- Ask students to brainstorm and record as many solutions as possible in their small group for their assigned/chosen context or problem.

    - Explain that the purpose of this step is to come up with solutions to the limits students described in the last question of the *Getting Rid of Gross Germs* Research Notes handout and solutions to the problems pinpointed in the *Spreading Germs Snapshots* handout.

- Remind students where they are headed in the unit. They are brainstorming ideas today, and they will choose one of these solutions and design it later. Therefore, they should not get too bogged down in considering materials or constraints in this brainstorming session.
- After 10-15 minutes, come back together as a whole class to discuss the process. Prompt students to reflect on the challenges and benefits of their group's brainstorming process.
- If time allows, prompt students to share some of their initial ideas with the whole class.
- Let students know that in the next activity, *Developing Our Germ-Stopping Solution*, they will be working on selecting promising solutions.

Informal Assessment

Class Discussion: Use class discussions to assess students' ability to participate in collaborative conversations and understanding of how to identify specific problems and solutions.

Brainstorming Solutions: Use the brainstorming solutions handout/brainstorming discussions in small groups to evaluate students' ability to follow agreed-upon rules for discussions and build on others' talk in conversations as part of the engineering process.

Extending the Learning

If you want to spend more time discussing and modeling the brainstorming process, use this PBS Kids resource, *Brainstorm*.

OBJECTIVES

Subjects & Disciplines

- **Biology**
  - Health
- Engineering

Teaching Approach

- Project-based learning

Teaching Methods

- Brainstorming
- Discussions
- Inquiry

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Learning and Innovation Skills
    - Communication and Collaboration
    - Creativity and Innovation
    - Critical Thinking and Problem Solving
  - Life and Career Skills
    - Social and Cross-Cultural Skills
- 21st Century Themes

    - Health Literacy
- Critical Thinking Skills
    - Analyzing
    - Applying
    - Creating
    - Evaluating
- Science and Engineering Practices
    - Constructing explanations (for science) and designing solutions (for engineering)
    - Obtaining, evaluating, and communicating information
    - Planning and carrying out investigations

National Standards, Principles, and Practices

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

• **CCSS.ELA-LITERACY.SL.1.1.A:**
Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
• **CCSS.ELA-LITERACY.SL.2.1.A:**
Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
• **CCSS.ELA-LITERACY.SL.2.1.B:**
Build on others' talk in conversations by linking their comments to the remarks of other's.
• **Speaking and Listening Standards K-5:**
Comprehension and Collaboration, SL.1.1
• **Speaking and Listening Standards K-5:**
Comprehension and Collaboration, SL.2.1

Preparation

What You'll Need

REQUIRED TECHNOLOGY

- Internet Access: Optional
- Tech Setup: 1 computer per classroom

PHYSICAL SPACE

- Classroom

SETUP

You may want to have students choose their problem or context during the previous activity, *Getting Rid of Gross Germs*, so that you can organize students into their project groups before this activity begins.

Students will work in these groups of three or four for the rest of the unit to collaborate on a solution to their chosen problem.

GROUPING

- Heterogeneous grouping
- Large-group instruction
- Small-group work

ACCESSIBILITY NOTES

Step 2: Provide students with three to four minutes to brainstorm individually before working in groups to provide all students a chance to bring ideas to the group.

BACKGROUND & VOCABULARY

Background Information

The engineering design process is a series of steps that engineers go through to solve a problem. The third step—imagine possible solutions—includes brainstorming ideas with a group. In this activity, students collaboratively brainstorm several solutions for how to stop the spread of germs to solve a specific problem for a specific context. Undertaking authentic professional practices in the science classroom (such as the engineering design cycle in this activity and throughout the *Germ Problem Solvers* unit) are crucial ways in which students can develop a broadened sense of what it means to be a scientist or engineer. Explicitly highlighting how students' classroom activities are the same as professional practices can foster their identification with science and engineering, leading to students' ability to "see themselves" as scientists or engineers, and even increase their desire to pursue STEM

disciplines in college or career pathways. Further, encouraging students to bring in their ideas about how they use science and engineering in their everyday lives provides the final link to holistically expand their sense of these subjects as taking place in many different contexts, not just in the classroom.

Prior Knowledge

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Recommended Prior Activities

- Feeling Yucky
- Getting Rid of Gross Germs
- Getting to Know Germs
- Invisible Villains

Vocabulary

Term	Part of Speech	Definition
brainstorm	*verb*	to discuss a problem and suggest solutions or ideas
context	*noun*	set of facts having to do with a specific event or situation.
engineering design process	*noun*	series of steps that guides engineers as they solve problems.
solution	*noun*	an answer to a problem.
tally	*noun*	a recorded number of items.

For Further Exploration

Articles & Profiles

- Teach Engineering: Engineering Design Process
- NPR: Hands-Free Faucets Can Harbor Nasty Germs
- Johns Hopkins: Latest Hands-Free Electronic Water Faucets Found to Be Hindrance, Not Help, in Hospital Infection Control