Empowering with Precision & Inclusivity

Companion Lesson to X-STEM All Access Episode "Science That Saves Lives"

Grade/ Grade Band 6-12	**Topic:** Communication and Team Building	
Brief Lesson Description: It is important for scientists to be able to communicate their results to a variety of people. In this video Dr. Sovak describes the benefits of having a diverse team. This lesson is designed to teach students why it is important to collaborate with others that don't always think like them. Students are challenged to design solutions with scientific principles, consider impacts, and embrace diversity while solving problems.		
Performance Expectation(s): **MS-ETS1-1- Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.** **HS-ETS1-2- Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.**		
Specific Learning Outcomes: Students will be able to design a protocol that is inclusive for different types of learners. Students will be able to explain why working with a diverse team is beneficial to communicating with others.		
Narrative / Background Information		
Prior Student Knowledge: Students can define protocol. Students understand how to design a protocol.		
Science & Engineering Practices: **Analyzing and Interpreting Data**-Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. ● Analyze and interpret data to determine similarities and differences in findings (MS-ETS1-3) **Constructing Explanations and Designing Solutions**- Constructing explanations and designing solutions in 9-12 builds on K-8 experiences and progresses to explanation and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ● Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)	**Disciplinary Core Ideas:** **ETS1.B-Developing Possible Solutions**-There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-3) Sometimes parts of different solutions can be combined to create solution that is better than any of its predecessors. (MS-ETS1-3) When evaluating solutions, it is important to the into account a range of constraints including cost, safety, reliability, and aesthetics and to consider social, cultural, and environmental impacts. (HS-ETS1-3)	**Crosscutting Concepts:** **Influence of Science, Engineering, and Technology on Society and the Natural World** ● The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)
Possible Preconceptions/Misconceptions: Students may believe that the process of science is purely analytical and does not involve creativity. This may be in part due to the fact that the Scientific Method is often presented as a linear and rigid representation of the process of science, yet many scientists recognize that creative thinking is one of the most important skills.		
LESSON PLAN – 5-E Model		

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

Today's lesson begins with viewing Dr. Mika Sovak's video Science That Saves Lives. Pose the following question: Why is diversity important to scientific investigation? After viewing the clip, ask students to come up with one word or phrase that summarizes Dr. Mika Sovak's journey. (Possible answers.: teamwork, diversity, respect, multiple intelligence, creativity, communication). Lead a short discussion about the purpose of Dr. Sovak's story to studying STEM.

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:
Procure the following materials prior to the lesson.

- Blindfolds
- Ruler
- Balance/ Scale
- Thermometer
- Graduated Cylinder
- Metal water bottle
- Plastic water bottle
- Soda can
- Rocks
- Vegetables or fruits (frozen and fresh)
- Balls (soccer, basketball, football, baseball, tennis ball)
- Shoe box/cardboard box

Before the investigation ask students: "have you ever been able to identify what was for dinner just by the smell, have you ever reached out to touch something you've never felt before, why did you do that?" Explain to students that there are multiple ways of knowing something and people have different strengths when it comes to learning.

Now ask students to divide into diverse teams of 4. Students should select their own teammates. Be mindful of collaborations by circulating and listening out for comments that may indicate frustration. Lead a discussion asking students what makes their team diverse and how will it lead to successfully completing the investigation.

Give students a blindfold, ruler, balance/scale, thermometer, graduated cylinder and the metal water bottle, plastic water bottle and a soda can. Ask students to design a protocol (a set of rules and guidelines for communicating data) for explaining an object to a person who cannot see the object. Suggest that students create multiple protocols: one using measurements and the instruments for measuring, one using prose and detailed descriptions, and another of their choosing like charades or Pictionary or one that combines the two.

Students will test their protocols: blindfold one teammate, use the protocol to describe the object and have their teammate guess what the object is. Students revise their protocols based on the findings and by answering the following questions:

1. Which objects were the easiest to describe? And why?
2. Which objects were the easiest to identify? And why?
3. Which objects were the most difficult to describe? And why?
4. Which objects were the most difficult to identify? And why?

EXPLAIN: Concepts Explained and Vocabulary Defined:
Diversity in STEM is extremely important. But what is diversity? Why would it be useful in science and engineering? (Ask students to brainstorm). Then share one of the following articles:

- Diversity in STEM: What It Is and Why It Matters, Sept 2014 Scientific American
- Why is Diversity Important for Science?, Fall 2014 Society of Physics Students
- Why Diversity in STEM Matters Nov 2021 Packard Fellowships for Science and Engineering
- Why Diversity In Science Is So Important May 2022 Forbes

Ask students to use evidence from the article(s) to write an answer to *why diversity in science and engineering is important*. (Possible answers: broaden perspectives on research questions, more inclusive data, leading to better results) and *how could diversity improve their protocols*?

Vocabulary:
Diversity- a range of different things, variety

ELABORATE: Applications and Extensions:
Prior to starting the elaboration section of this lesson, you will need to gather the following materials (per group):

- Collection of rocks

- Vegetables or fruits (frozen and fresh)
- Balls (soccer, basketball, football, baseball, tennis ball)
- Shoe box/cardboard box

Explain to students they are going to compete to identify the items in the box using another team's protocol for identifying objects. The winner is the team whose protocol allows the most items to be identified.

Have teams identify the person who will identify the objects and blindfold* them and make sure their backs are turned away from the box. Using the protocol teammates select one item from the assigned box and describe the object without saying the name of the item. Continue selecting items until they are all identified, or time is called (15-18 minutes max).

Students then reflect on the following questions:

1. Which objects were the easiest to describe? And why?
2. Which objects were the easiest to identify? And why?
3. Which objects were the most difficult to describe? And why?
4. Which objects were the most difficult to identify? And why?
5. What did you notice about your ability to describe the objects? What was your strength when it comes to communication?
6. What did you notice about your ability to identify objects? What was your strength when it comes to listening?
7. Did you improve with practice?
8. What were the strengths and weaknesses of the protocol you used?
9. If you had to create a new team, what skills would you be looking for and why?

*Blindfold unless a protocol requires looking at sketches

EVALUATE:

Formative Monitoring (Questioning / Discussion): Students identifying the objects and responses to questions asked during the lesson

Summative Assessment (Quiz / Project / Report): Protocols, written report and answers to the question will determine if students understand how to create an inclusive protocol and why it is important

Elaborate Further / Reflect: Enrichment: Students identify their strengths as learners using this Multiple Intelligences Survey then they recreate a more diverse team to repeat the experiment by creating a new protocol and comparing it with the winning one.

SOCIAL EMOTIONAL LEARNING ACTIVITY

CASEL Competency: Self- Management
The ability to manage one's emotions, thoughts, and behaviors can be tricky in stressful situations. Ask students to think about a stressful situation when their emotions get the best of them. Then have students pair up and share that stressful situation and describe how they behaved. Ask for volunteers to share out loud with the class. Then tell students they are going to learn a quick and easy strategy for managing their emotions and behaviors in stressful situations. Introduce mountain breathing as a mindful breathing technique. Students visualize 5 mountain peaks, they inhale through the nose as they move up the mountain, hold at the peak, then exhale through the mouth visualizing moving down the mountain, and repeat four more times.

INTERDISCIPLINARY CONNECTIONS/IDEAS

CCSS.ELA-Literacy.WHST.9-20.8: **Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.**

CCSS.ELA-LITERACY.SL.8.1: **Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.**

Materials Required for This Lesson/Activity

Quantity	Description
Per group (4-6 students)	Blindfolds
Per group (4-6 students)	Ruler
Per group (4-6 students)	Balance/ Scale
Per group (4-6 students)	Thermometer

Per group (4-6 students)	Graduated Cylinder
Per group (4-6 students)	Metal water bottle
Per group (4-6 students)	Plastic water bottle
Per group (4-6 students)	Soda can
	Collection of rocks
	Vegetables or fruits (frozen and fresh)
	Balls (soccer, basketball, football, baseball, tennis ball)
	Shoe box/cardboard box

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