Science Context-Setting Activity: How Do Scientists and Engineers Work Together on NASA Missions?

Educator Preview

Activity Overview

Youth learn about the ways that scientists and engineers rely on each other during NASA missions by watching a video and playing a card matching game. They learn their NASA challenge is to choose the best Mars landing site for a rover.

Timing		**Prep Snapshot**	**21st Century Skills Connection**
Introduction	5 min	Prep Time 30 min • Print the *Family Connections Flyer* and consider family engagement options. • Copy cards for each group of 4.	• Collaboration • Critical Thinking **Science Practices** • Obtaining, evaluating, and communicating information.
Video and Card Game	25 min		
Reflect	5 min		
Total	**35 min**		

Guiding Question	**Youth Will *Do***	**Youth Will *Know***
How do scientists and engineers work together on a NASA mission to learn about another planet without going there?	• Draw connections between questions asked by scientists and those asked by engineers.	• On NASA missions, engineers design technologies to help planetary scientists gather data to answer their questions. • Remote sensing technologies gather data from a distance. • They have a NASA science challenge to solve.

Connecting Across Activities

In this Activity, youth explore how scientists and engineers work together and they learn their task for the rest of the Activities: to interpret remotely sensed data to choose the best landing site on Mars to search for evidence of water. In Science Activity 1, they explore landforms and use visual data to think about different landing sites on Mars.

Educator Resources
Access Activity resources using link or QR code.

Activity Resources

QR code leads to resources available for this Activity.

https://planets-stem.org/**betars-sp1**/

Family Connection

If time permits, have youth ask the following questions to their Elders, families, or mentors before the Activity:

Q: Can you tell me a story about a technology or tool that made a big difference in your life?

Materials and Preparation

Materials

For the whole group

- *Special Report* video (9:51) and way to display it to the group
- a way to record ideas, such as chart paper or a shared document
- rubber bands, paper clips, or small bags (to hold cards)

For each group of 4

- *Science and Engineering Questions* cards

For each youth

- Science Notebook
- Family Connections Flyer

Context Setting Activity Preparation (30 min)

1. Watch and prepare to play the *Special Report* video (9:51). Plan to stop the video at 9:28.
2. Make one copy of *Science and Engineering Questions* cards for each group of 4. Cut out the cards and use rubber bands, paper clips, or small bags to keep each deck together.

Supporting Learner Differences

Consider the needs of the youth in your group when preparing the card sets so all youth can interact with them.

3. Review, fill, print and prepare to send home the Family Flyer with each youth in your program.

4. Consider one of the following ways to engage families based on your own capacity and your specific group of youth's context:

    - Consider inviting families to either fill the role of a guest speaker or identify someone to act in this role and coordinate with you about scheduling.
    - Consider asking families to discuss one or more questions with their youth at home and then invite youth to share what they learned.
        - Main unit question: Can you tell me a story about a technology or tool that made a big difference in your life?
        - Other questions by Activity are available.

5. Invite families to the science showcase to not only share in celebration of their child's accomplishments but also provide their knowledge (cultural or otherwise) about the engineering of the unit. There is time set aside for this in Activity 4.

Activity Guide

Guiding Question: How do scientists and engineers work together on a NASA mission to explore another planet without going there?

Post the question somewhere accessible, such as on chart paper or a shared document, so that youth can refer to it throughout the activity.

Introduction (5 min)

1. Consider sharing with youth in your program prior to beginning the unit, that you hope to not only experience NASA science together but also learn together from youth, their families, and communities about similar types of science they have done. You can show them the letter that invites their families to share in the learning. Ask youth:

   Q: What questions do you have about learning with your families?

   A: Accept all responses. Youth may share their caregiver is too busy or that they would rather not ask them science questions. If this is the case, respect this wholly and either consider the guest speaker option or help youth brainstorm relationships that might be a better fit, like Elders, grandparents, older siblings or cousins, coaches, advisors, or other staff at your program or their school.

2. Ask youth if they know about NASA or NASA missions that are currently in space. Tell youth that today, they will think about what is necessary for getting answers to science questions on NASA missions.

3. Share the Guiding Question with youth:

   Q: How do scientists and engineers work together on a NASA mission to explore another planet without going there?

4. Tell youth that today, they will think about technologies that solve a specific problem: gathering information from a distance. Ask:

   Q: What tools can you use when you want to gather information, such as sight or sound, from a distance?

   A: Responses will vary. Possible responses include cell phones and towers, drones, telescopes, binoculars, cameras, satellites, x-ray machines, night-vision goggles, and sonar.

   Youth may share their experiences using these technologies or others like them. They may also share examples of technologies used in their local community, such as for mapping or weather forecasting.

Special Report Video and Card Game (25 min)

1. Have youth turn to *Remote Sensing Technologies*, pages 2 – 3 in their Science Notebooks. Explain that youth will complete it as they watch a short video to learn more about the field of remote sensing and the types of technologies that scientists and engineers use and the types of information they gather. Play the *Special Report* video, stopping the video at 9:28. (Its full runtime is 9:51.)

2. After the video, ask one or more of the following:

   Q: How do scientists and engineers work together on NASA planetary missions?

   A: Scientists want to understand the planets in our solar system and where they came from. Scientists rely on engineers to design instruments to collect data about the solar system and spacecraft to get the instruments into space and back. There is more to the universe than our senses can detect, but scientists can work with engineers to design technology to expand our senses and understanding.

Supporting Youth Thinking

Emphasize that for NASA missions, science questions are *why* engineers design the technology. The technology that engineers design is *how* scientists get the data they need to answer science questions.

3. Ask:

   Q: How would you define *remote sensing*?

   A: Responses will vary. Possible definitions include "gathering information from a distance" and "learning about things that are far away."

   Discuss and generate a definition as a group. Record the definition of ***remote sensing*** that youth generate in a form that can be saved and accessed, such as on a poster or in a shared document.

   Q: What questions do you have about remote sensing?

   A: Accept all responses.

   Attempt to answer questions or explain that they will be answered later in the unit.

Connecting Across Activities
Be sure to save youth's definition of and questions about remote sensing for use in later activities.

4. Say, "To see how much you learned about how scientists and engineers work together on NASA missions, we're going to play a card game." Distribute a deck of *Science and Engineering Questions* cards to each group of four youths. Explain that their task is to sort the cards into two piles: questions that scientists ask, and questions engineers ask. Provide time for youth to sort the cards.

5. After a few minutes, discuss as a group which questions went into each pile. Ask:

   Q: How did you decide which questions are usually asked by scientists, and which are asked by engineers?

   A: Responses will vary. Possible responses include that scientists ask questions about Mars, but engineers ask questions about how to find out about Mars. Some groups may have sorted the questions into different piles. Encourage them to explain why they sorted the questions that way.

6. Tell youth that the science and engineering questions are in pairs. Each pair is about the same thing. Now the cards are sorted, they can match the science questions to engineering questions. Provide some time for youth to match the cards.

7. Talk about why youth matched the cards the way they did. Ask one or more of the following questions:

   Q: How did you match the cards?

   A: Accept all responses with justification. A possible response is that we matched "Is there water on Mars?" with "What tools can we use to search for water on Mars?" because engineers answering the second question will help scientists answer the first one.

   Q: Was matching the cards easy or hard?

   A: Accept all responses with justification. A possible response is that it was easy because matching cards use the same words, like "water" and "landform."

   Q: Does anyone disagree with how the cards were paired? Why?

   A: Accept all responses with justification. A possible response is that "What kind of device can help identify minerals on Mars?" could help answer the question "What is underneath the surface of Mars?"

Note

Scientists and engineers work together on NASA missions to explore planets, but they have different goals. NASA scientists ask questions about the planets, and NASA engineers design technologies that gather data to help answer those questions.

Reflect (5 min)

1. Introduce the goal for the rest of the science activities by saying: “Did you know multiple teams of people at NASA analyzed a lot of remote sensing data to choose the best place on Mars to send the Perseverance rover to look for evidence of water? NASA wants to send another rover to Mars. Now you get the chance to do the work of NASA scientists! Your teams will examine multiple types of data to choose the best landing site for a rover.”

2. Encourage youth to think about information the scientists need by asking the following question:

   Q: What kinds of information do you think we will analyze?
   A: Responses will vary. Possible responses include images and topographic maps.

3. Return to the Guiding Question. Ask:

   Q: How do scientists and engineers work together on a NASA mission to another planet without going there?
   A: Scientists have questions that they want to answer. Engineers develop remote sensing technologies, which are based on knowledge of science, to help answer those questions. Engineers test their technologies on Earth before sending them into space. Once in space, the instruments return data to Earth for scientists to interpret. Scientists use information (data) from the mission to answer the questions that drive the mission (the why), and engineers design technology that can gather the information for the scientists (the how).

4. Tell youth that their goal over the next few sessions will be to analyze data collected by remote sensing technologies like those in the video to recommend the best landing site for a Mars rover that is looking for evidence of water. In the next activity, they will learn more about the types of data that help scientists find evidence of water, like landforms, so they will want to talk to their families about landforms before they meet again.

Connecting Engineering and Science

The Engineering Series activities have youth design remote sensing technologies to gather information that will help scientists choose the best location to send a rover.

After the Activity

1. Plan ahead for Science Activity 1. See Activity 1 Materials Preparation on page 21.

2. Take time to reflect on the following educator prompts.

   Q: What strategies worked to get youth engaged with today's activity? How could you use similar strategies during future activities?

   Q: What are your teaching strengths? Reflect by filling out *My Educator Profile*.

Remote Sensing Unit Resources

QR code leads to resources available for this unit.

https://planets-stem.org/**betars-unit-landing-page**/

Science Prep Activity

My Educator Profile

Record your teaching strengths. You can write, draw, or check off boxes below.

☐ **Cultural Responsiveness**
- I give youth opportunities to work on topics that are meaningful to them.
- I value the assets that youth bring to their learning.

☐ **Experiential Activities**
- I help youth make meaning through active engagement.
- I help youth reflect on their experiences.

☐ **Local Relevance**
- I connect topics to the local community.
- I give youth chances to use their local knowledge.

☐ **Multilingual Learning**
- I use strategies to support youth of all linguistic backgrounds.
- I focus on what youth can do at all levels of language learning.

☐ **Real-World Relevance**
- I demonstrate how topics matter in the world.
- I help youth understand how different careers help people, animals, the environment, and society.

☐ **Subject Integration**
- I make connections between academic subjects.
- I give youth opportunities to use their knowledge from other subjects when learning.

☐ **Universal Design for Learning**
- I plan for learner variability among youth.
- I provide youth with multiple means to engage, represent information, and express themselves.

Record teaching areas where you want to learn or develop.

Do you think there has ever been life on Mars?

We will be doing activities based on NASA science where your young scientist will investigate the evidence for past life-supporting environments on Mars!

These activities were designed to be inclusive. We invite you to share your own, your child's, and your community's background knowledge.

HOW HAS A TOOL OR TECHNOLOGY MADE A DIFFERENCE IN YOUR LIFE?

CAN YOU SHARE A STORY WITH OUR PROGRAM?

WAYS TO GET INVOLVED

- Reach out to your program to share knowledge or suggest someone else who might do this.
- Come to the Science Showcase.
- Share what you know with your child at home.

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Scan the QR code to learn more. ->

NASA Partner

Pick 1 or 2 story prompts to discuss at home

Activities I'll do:	Can you tell me a story about...
Science Context	... a technology or tool that made a big difference in your life?
Science Activity 1	... why water is important to our family? ... a memory about the water where we live? ... a landform we live near?
Science Activity 2	... our landscape / the land on which we live?
Science Activity 3	... identifying parts of nature that were important to you like plants, rocks, minerals, animal tracks, etc?
Science Activity 4	... how you made an important decision? Did you follow a process? Who did you talk to?

Make it a two-way conversation:

What questions do you have about the science activities I am doing in my program?

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