Engineering Activity 5: Improve a Remote Sensing Device

Educator Preview

Activity Overview

Youth improve their remote sensing devices by making them easier to use, more compact, or better able to gather high-quality data.

Activity Timing		**Prep Snapshot**	**21st Century Skills Connection**
Introduction	5 min	Prep Time 10 min Copy Showcase invitations. Set up Space Screens and Materials Table.	• Collaboration • Creativity • Critical Thinking **Habits of Mind** • Make evidence-based decisions. • Persist and learn from failure.
Final Test	45 min		
Reflect	5 min		
Total	**55 min**		

Guiding Question	**Youth Will *Do***	**Youth Will *Know***
How can we improve our remote sensing devices?	• Consider the results of their testing and use what they have learned to modify their designs.	• Engineers reflect upon, alter, and improve their designs.

Connecting Across Activities

In the previous Activity, youth designed and tested remote sensing devices. In this Activity, they use what they learned to improve their devices. In Engineering Activity 6, they will meet with community members at an Engineering Showcase to have conversations about their designs and remote sensing.

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-activity-a5**/

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 something you built that didn't work or work as well as you wanted it to? What did you do to improve it?

Materials and Preparation

Materials

For the whole group

- engineering design process depiction created in the Engineering Prep Activity
- *Remote Sensing Definition* chart paper created in the Engineering Prep Activity
- *Filter Investigations* chart from Engineering Activity 2
- *Scraper Investigations* chart from Engineering Activity 2
- crayons and markers
- Model landscape sites and Space Screens from Engineering Activity 4
- remaining materials from Engineering Activity 4
- 50 sticks, craft
- 75 sticks, fuzzy
- 25 sheets of paper, construction
- 25 sheets of paper, copy

For each group of 4

- remote sensing devices from Engineering Activity 4
- 1 pair of scissors
- 1 ruler
- 1 roll of tape, masking
- 2 *Data Collection Grids* (copied from page 67)

For each youth

- Engineering Notebook

Activity 5 Materials Preparation (10 min)

1. Arrange the Space Screens according to *Space Screen Assembly*, page 103 of this guide.

2. Create a Materials Table with the remaining materials from Activity 4.

3. Make copies of the *Engineering Showcase Invitation*, page 117 in this guide, for youth to distribute to their family and friends.

4. Post youth's engineering design process depiction.

5. Post the *Remote Sensing Definition* chart paper and *Filter* and *Scraper Investigations* chart papers from Engineering Activity 2.

Activity Guide

Guiding Question: How can we improve our remote sensing devices?

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. If you sent youth home with the Family Connection question, ask:

   Q: If anyone talked to their families about improving something that didn't work as well as it could, would you like to share about it?

   A: Accept all responses.

2. Have youth think back to the previous activities. Ask:

   Q: What problem are we trying to solve? What have we done so far to solve it?

   A: We want to gather information from a distance to answer questions that scientists have. We have designed light redirection systems so we can change the path of light using mirrors. We have designed devices that include filters or scrapers so that we can gather information about minerals by looking at certain colors of light. We have designed LiDAR so we can learn about the topography.

3. Share the Guiding Question with youth:

   Q: How can we improve our remote sensing devices?

   Let youth know that today they will improve their remote sensing devices to make them even better. Remind youth of the step(s) in their engineering design process that involve improving technologies. If appropriate, have them discuss what those steps involved and their previous experiences using them. Let groups know they should plan and test all the improvements they want to make today before they share their final design with visitors in the next activity.

Final Test (45 min)

1. Let groups know that room on a spacecraft is usually very limited, so one way to improve their remote sensing device is to make it as small and compact as possible. Share examples of spacecraft with multiple remote sensing instruments, such as the Mars Reconnaissance Orbiter.

Supporting Learner Differences

Youth can challenge themselves to make their remote sensing devices compact enough to fit into a box of a specific size. To make the box, fold a piece of construction paper in half to form a 8.5″ × 5.5″ rectangle. Challenge youth to fit their devices on the rectangle.

For an added challenge, unfold the paper to form two 8.5″ × 5.5″ rectangles. Place the paper on a surface so one rectangle is flat and one stands up vertically. The paper now shows two sides of an imaginary 8.5″ × 5.5″ × 5.5″ box. Challenge youth to fit their devices in this three-dimensional box.

2. Remind groups that they can refer to *Remote Sensing Plan*, page 34 in their Engineering Notebooks, and add notes as they improve their designs.

3. Have groups share their results, discuss problems, or give advice from the last activity. Consider asking some of the following questions:

   Q: Which scientist did you choose to work with, and were you able to collect the information they needed?

   A: Responses will vary.

   The scientists are Jaime, Caris, and Alex. Youth may or may not have gathered the information they needed about topography, landing sites, and minerals.

   Q: What about your design is working well?

   A: Accept all responses. Possible responses include features of the light redirection systems, optical filters, scrapers, and LiDAR.

   Q: What challenges did you encounter?

   A: Accept all responses. Possible responses include positioning the remote sensing device and interpreting the data it provides.

4. Allow groups to collect materials and begin working. Ask questions such as the following:

   Q: How are you improving your design?
   A: Responses will vary. Possible responses include that we are making it fold up so it can be smaller or focusing on one area to get more detailed data.

   Q: Are your improvements working out the way you thought they would?
   A: Accept all responses.

   Q: What else can you do to improve your design?
   A: Responses will vary. Possible responses include finding a way to use fewer materials or make the device easier to position.

5. When groups are ready to complete final testing, have them turn to *Guidelines for Testing Devices*, pages 31 – 32 in their Engineering Notebooks, and review the guidelines.

6. Have groups test their improved remote sensing devices and record the data they collect on *Data Collection: Improve*, pages 35 – 36 in their Engineering Notebooks.

7. As groups are working, circulate among them and ask questions such as the following:

   Q: Is your device collecting better-quality data for the scientists? How do you know?
   A: Accept all responses. Possible responses include comparisons that the device can tell the differences between minerals better or can measure topography better.

   Q: What types of information are you able to collect so far?
   A: Possible responses include information about topography and minerals, data in the form of light, and data in the form of sound.

   Let groups that are still working know when there are ten and five minutes remaining.

Reflect (5 min)

1. Have youth reflect on the Guiding Question:

   Q: How can we improve our remote sensing devices?

   A: Accept all answers. Possible responses include by making it easier to move, choosing different optical filters and scrapers to gather data in different forms, and using more or fewer straws in our model LiDAR.

2. Have youth consider their engineering design process depiction. Ask:

   Q: Which steps of an engineering design process did you use as you were engineering your remote sensing devices?

   A: Accept all answers. A possible response is that we planned how we wanted to change our design, then we created, tested, and improved it.

3. Let youth know that in the next activity, they will share their designs and the information they collected with an audience. Support their understanding by asking questions such as the following:

   Q: Why is it important to share what we have done and learned?

   A: Accept all answers. Possible responses include to help scientists plan missions, to convince NASA to send our device into space, and to give other members of our community a chance to share what they know.

4. Have groups label their remote sensing devices and store them in a safe location so they can use them at the Engineering Showcase.

5. At the end of the session, hand out copies of *Engineering Showcase Invitation*, page 117 in this guide, for youth to share with family and friends.

After the Activity

1. Save each group's design, the Space Screens, and the landscape sites for the Engineering Showcase.

2. Plan ahead for Engineering Activity 6. See Activity 6 Materials Preparation on page 121.

3. Take time to reflect on the following educator prompt.

   Q: How did you support constructive group work during this activity?

Remote Sensing Unit Resources

QR code leads to resources available for this unit.

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

You're invited to the Engineering Showcase

COME SEE YOUR YOUNG ENGINEER SHARE THEIR REMOTE SENSING DEVICE

We will also invite you to share something you know, or an experience you've had, that relates to engineering and technology

Date: _____

Time: _____

Location: _____

PLANETS