SCIENCE CAREER ADVENTURES

NASA Geologist: Earth's Resources

NGSS Standard: MS-ESS3-1

Adventure Description:

In this adventure, you will think like a geologist and design a drone to capture data on how glaciers change over time.

Activity

Teacher Note: This activity is long. We suggest splitting it across multiple days. We suggest the following: Steps 1-2 on Day 1, Steps 3-4 on Day 2, and Step 5 on Day 3.

Teacher Prep: Flubber should ideally be prepared ahead of time. It will take about 20 minutes to make flubber for one class. See Handout: Preparing Flubber. Note: Flubber will still be usable several days after created, as long as it is kept in a sealed container or bag.

Step 1: Background Information on Geologists and Glaciers (5 minutes)

- Show Video: Earth's Resources
- Discuss the movement of material inside of glaciers. Explain that rocks, minerals, and other materials can be frozen inside of glaciers. As the glaciers melt, the outside layer of the glacier moves and "flows", moving the materials that are frozen inside the glacier. Discuss how geologists can use this information to learn more about how an increase in the Earth's temperature affects glaciers.
- Show Handout: Glaciers and Earth's Surface. Discuss how geologists study the movements of glaciers to learn more about how the surface of the land was shaped. Explain that the movements of glaciers formed structures over thousands of years as they very slowly melted and moved.
- Explain to students that geologists use tools, like satellites or drones, to collect data on glaciers. Discuss reasons why geologists would use a drone or satellite to learn about glaciers (ex: glaciers are often located in remote places that are difficult for humans to access, and glaciers change slowly over time so the necessary data can't be collected in one trip).

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Step 2: Creating a Drone (20 minutes)

- Explain to students that they will create a new drone that can capture data on how glaciers change over time.
- Provide students with Handout: Creating a Drone. Walk through the steps as a class.
- Divide students into pairs or small groups. Provide groups with the following materials:
  - Art supplies (e.g., tape, scissors, popsicle sticks, pipe cleaners, construction paper)
  - Building materials (e.g., recycled items, straws)
  - Ruler (to measure length and height of drone)
- Note: Each group will also need 1 smartphone and a charger. Groups should only use a device that is in a durable case in case it slips out of someone's hand or falls during the activity.

Step 3: Preparing Glaciers (10 minutes)

- Explain to students that they will now use their drone to collect data on glaciers. Because they cannot go visit a glacier, groups will create models of glaciers.
- Provide groups with Handout: Preparing Glaciers. As a class, read through the steps. Discuss how students will receive a cup of flubber, which represents a glacier. They will also be given a handful of beads, which represents pieces of Earth.
- Provide groups with the following materials: 1 cup of flubber, cookie sheet, beads, and plastic wrap.
- Have groups line their pan with plastic wrap. Then, students should place their flubber on one end of the pan and add the beads to simulate pieces of Earth stuck in the glacier.

Step 4: Capturing Data (25 minute to set up; 2 hours to capture all data)

- Explain to groups that they will use their drone to capture data on their glaciers. Specifically, the smartphone that is attached to the drone will take video of the glacier for two hours.
- Next, discuss how geologists sometimes create create time lapses of their videos. Glaciers change very slowly, over months or years. No one can sit and watch a month long video! Time-lapse allows scientists to show the changes that happen over long periods of time in just a few minutes or even seconds! Students will create a time-lapse of their video so they can see the changes in their glacier without watching all 2 hours of video footage from their drone.
- Next, explain that some groups will capture data on glaciers affected by global warming. These groups will be given a heat lamp that will add heat to their glacier. Other groups will capture data on glaciers that melt under “normal” conditions.

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- Provide students with Handout: Capturing Data on How Glaciers Change. Walk through the steps as a class.
- Teacher note: By having some groups study glaciers melting under global warming conditions and having others study normal melting, the class will be able to figure out how global warming causes glaciers to melt at an accelerated pace. This idea will be discussed during the reflection in Step 5.
- Provide half of the groups with a heat lamp. These groups will be studying a glacier affected by global warming. The other groups will be studying a glacier under "normal" conditions.
- Designate a student from each group that is responsible for returning to the classroom after 2 hours. This student will also be responsible for making sure the video is uploaded to the cloud so that it is saved. It is important to choose a student who is reliable.

Step 5: Analyzing Data and Reflection (10 minutes)

- Explain to students that they will be comparing their video results with another group to see how their time-lapsed videos are similar and different.
- Pair a group that used a heat lamp with a group that didn't use a heat lamp. Explain to students that they will watch both groups' videos side by side to see the differences between how the two glaciers melt. Have students spend a few minutes discussing similarities and differences between the two videos.
- Then, have a whole-class discussion about the difference between the videos when there is a heat lamp versus no heat lamp present. Discuss how the glacier under the heat lamp should have melted faster due to the heat.
- Then, discuss the following:
  - Why are geologists concerned about glaciers' melting? Discuss how geologists are concerned with how quickly glaciers are melting because they can contain pieces of Earth. These pieces have become frozen inside the glacier, and as the glacier melts, they are moved by the melting process. This is one way that pieces of the Earth can be moved. When the glacier is warmer, melting occurs faster, which moves the pieces of the Earth that are stuck inside the glacier at a faster pace.
  - Does the top or the bottom of the glacier melt faster? Which moves more as it melts? The top moves faster, because there is friction between the bottom of the glacier and the ground. The top of the glacier "flows" over the bottom of the glacier.

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Materials List

Provided online:

- Video: Earth's Resources
- Handout: Teacher Prep: Creating Flubber
- Handout: Glaciers and Earth's Surface
- Handout: Creating a Drone
- Handout: Preparing Glaciers
- Handout: Capturing Data on How Glaciers Change

Not Provided online (each student or group needs):

For Teacher Prep (note: this is enough for 6 groups):

- 2 gallon sized bags for mixing ingredients
- 6 small Ziploc baggies to store flubber (one for each group)
- 3 3/4 cups warm water (optional: with 8 drops of blue food color added)
- 3 cups white glue
- 6 teaspoons Borax

For Step 2: Creating a Drone

- Smartphone capable of recording a video for 2 hours
- Charger for smartphone
- Art supplies (popsicle sticks, pipe cleaners, tape, scissors, construction paper, etc.)
- Building materials (recycled materials, nuts, bolts, etc.)
- Ruler

For Step 3: Preparing Glaciers

- One cookie sheet
- Clear plastic wrap, enough to cover cookie sheet
- Small handful of beads
- Heat Lamp (only half of the groups will need a heat lamp)

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