THOSE WHO HAVE COME BEFORE ME

Activity topic selected from NASA's KSNN™ 21st Century Explorer newsbreak "Are we there yet?"

Educator Section

Grade Level: 3-5

Connections to Curriculum: Science and Geography

Science Process Skills: observing, predicting, communicating
(Association for the Advancement of Science)

Teacher Preparation Time: 30 minutes

Lesson Duration: 45 minutes

Prerequisite: none

National Education Standards addressed in this activity include Science (NSES) and Geography (NCGE). For an alignment to standards in this activity, see page 5.

Introduction

Though humans have explored the Earth from the poles to the seas, there are still new frontiers to explore. Just as people once looked beyond the horizon, today they look beyond the sky to space. NASA's astronauts, supported by many scientists, engineers and others, are carrying exploration onward to new worlds.

Lesson Objective

This lesson demonstrates the benefits of learning from the experiences of past explorations.

Problem

How can I learn from past explorations?

Learning Objectives

The students will

- gather data through careful observations.
- create a map based upon observations.
- develop a conclusion based upon the results of this activity.

Materials Required

small household or classroom items

envelopes

blank paper

colored pencils or markers

sticky notes

stopwatches

maps

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NASA's KSNN™ 21st Century Explorer 30-second newsbreak – "Are we there yet?"

Materials

- NASA's KSNN™ 21st Century Explorer 30-second newsbreak, "Are we there yet?" (Download the newsbreak at http://ksnn.larc.nasa.gov.)
- maps of the same area from the 1700s, 1800s, and today (home town, the globe, etc.)
- a large space is required for this activity

Per group (3 or 4 students per group)

- Hidden Items for the exploration:
  - 5 sticky notes (numbered 1-5)
  - 5 small household or classroom items. These may be everyday items (like rocks, books, cups) or items related to exploration such as models of planets, ships, or spacecraft.

  See how to label and prepare the Hidden Items in the Pre-Lesson Instructions Section.
- designated section
- 1 envelope
- 4 sheets of blank paper
- colored pencil or marker
- stopwatch, or timepiece with a second hand (watch or clock)

Per student

- Those Who Have Come Before Me Student Section

Safety

Remind students about the importance of classroom and lab safety.

Pre-lesson Instructions

- Students should work in groups of 3 or 4.
- A large space is required for this activity such as the gym, library, cafeteria, or a large classroom.
    - This space needs to have places and other objects to put the items in and around to make them blend into the area (shelves, desk tops, chairs, cabinets, etc.)
    - Divide the area into sections. If you have 6 groups of students, you'll need to divide the space into 6 separate sections. If you have 5 groups, then 5 sections are needed, and so on.
- Prepare the Hidden Items.
    - Number the items 1-5 for each section with a "sticky note". You should have 5 items in each section.
    - In each section, hide the 5 numbered items. Place the items so that the students cannot see the numbers.
- Post directions (NSWE) in the room for use during this activity to aid the map drawing.
- Label the envelopes with a section number. Throughout the explorations, the envelope should stay in the corresponding section.
- Acquire maps of the same area from the 1700s, 1800s, and today. (Use your home town, the globe, etc.)

Lesson Development

To prepare for this activity, the following background information is recommended:

- Read NASA's KSNN™ 21st Century Explorer Web Text Explanation titled "Are we there yet?" at http://ksnn.larc.nasa.gov.
- Read the following text taken from the Observation Section of the Those Who Have Come Before Me Student Section.

Observation

Explorers are the people who, through trial and error, create new ways of doing things and going places. Sometimes explorers fail during their journeys, but, they learn through their mistakes, so that those who come after them will not make the same errors. Whether they are searching the ocean, the rain forest, a desert, or space, exploration ties them all together.

Explorers expand our world. Portugal's Vasco da Gama succeeded in reaching India and returned with jewels and spices. Ferdinand Magellan, another Portuguese explorer, was the first to sail around the globe. In the name of Spain, the Italian explorer Christopher Columbus was the first to sail to the "New World". While searching for the "Fountain of Youth" the Spanish explorer, Juan Ponce de Leon reached Florida. Years later, Alvar Núñez Cabeza de Vaca landed on the west coast of Florida, claiming that land for Spain. His travels then took him across what are now Texas, New Mexico, and Arizona.

In our exploration into space, we have made many discoveries and we have learned many things. Even though we have only been traveling in space for a short time, our technology, our knowledge, and our world have improved drastically. Sending men and women into space

does more than just explore the unknown; it brings a new understanding to our world and society.

> "This cause of exploration and discovery is not an option we choose; it is a desire written in the human heart. We are that part of creation which seeks to understand all creation."
>
> – U.S. President George W. Bush

In 1969, Apollo 11 astronauts Neil Armstrong and Buzz Aldrin earned their place on the roll of explorers when they became the first men to set foot on the moon. Today, crews of the space shuttle and the International Space Station are learning to live the unfamiliar environment of space. Soon, NASA will once again be sending explorers into uncharted territory as the Vision for Space Exploration sends humans back to the moon, on to Mars, and beyond.

In this activity, your group will be required to finish an exploration as quickly and efficiently as possible. You will also leave information so that those who follow you will complete the journey faster and not make the same mistakes that you might have made.

Brainstorm: Make a list of people that you think are explorers. What traits do these explorers share?

- If needed, additional research can be done on the following science topics:
  - Apollo Missions
  - Royal Research Ship (RSS) Discovery
  - NASA's Vision for Space Exploration

Instructional Procedure

Throughout this lesson, emphasize the steps involved in the scientific method. These steps are identified in ***bold italic*** print throughout the Instructional Procedure Section.

1. Show NASA's KSNN™ 21st Century Explorer newsbreak "Are we there yet?" to engage students and increase student knowledge about this topic.
2. Remind students about map making; topics to include are a compass rose, the legend, and scale. The legend should explain the meaning of the colors, line types and symbols on their maps. Scale in this activity is relative to student size, for example, younger students could use "steps" whereas older students could use centimeters and meter sticks.
3. Review the problem with the students.
   Problem: How can I learn from past explorations?
4. Have the students read the ***Observation*** Section in the Those Who Have Come Before Me Student Section and discuss in their groups.
5. As a class, have students study maps of the same area from the 1700s, 1800s, and today. (Use your home town, the globe, etc.). Discuss how the maps become more precise, as yours will in the activity today.
6. Encourage your students to discuss and make ***observations*** about this topic by completing the first two columns in the KWL (KNOW/WANT TO KNOW/LEARNED) chart on the Those Who Have Come Before Me Student Section. Use the KWL chart to help students organize prior knowledge, identify interests, and make real-world connections. As students suggest information for the "KNOW" column, ask them to share "How they have come to know this information."
7. Ask your students if they have predictions relating to this activity and the "problem question". Help them refine their predictions into a ***hypothesis***. In their Student Section, they should restate the "problem question" as a statement based upon their observations and predictions. Encourage students to share their hypothesis with their group.

8. Students will ***test*** their hypothesis following this procedure.
   (The following steps are taken from the Student Section. Educator specific comments are in italics.)

   Assign each group of 3-4 students an exploration section with pre-hidden items.

   1. As a group, go to your assigned exploration section.
   2. Decide on a group name. Write the group name on the back of your envelope. This envelope will stay in this starting section.

      Make sure the students read and understand steps 3-11 before beginning the explorations.

   3. Your teacher will assign each group member a role to play in the exploration. Roles include map maker, time keeper, recorder, and lead explorer.

      Assign roles to the students for the first exploration, and have each student choose a different role for each exploration. Roles: map maker, time keeper, recorder, and lead explorer.

   4. The map maker will draw a map of your section. Your map should include a compass rose, a scale and a legend. Draw the large items in the section and include them in the legend, for example: chairs, computers, tables, etc.
   5. Title your map "Exploration 1".
   6. You and your group members are on an exploration for 5 items. These items are numbered 1-5.
      - The lead explorer must find the items in the correct number order. If the lead explorer finds an item out of order, your group cannot count it as "found" until the lead explorer has found the items numbered before it. For instance, the lead explorer can not count item #3 as "found" until he/she finds #1 and then #2.
      - When an item is "found" in order, leave it in its location and have the recorder mark it on your map.

      Once an item is "found" the students should put it back in the exact place where it was found, for the next group to discover.

   7. The time keeper will use the stopwatch to time the exploration.
   8. During the exploration, the recorder will mark the exploration route on your map.
      - The recorder will draw on the map with a colored pencil or marker to show the route that was taken to find the items. The map should reflect the route of the lead explorer.
      - Mark the starting point, where each item was found, and the ending point. Draw one continuous line to show the exploration "path".
      - All "wrong turns" should be tracked on the map. This means your map may be a bit messy.
   9. Once all 5 items have been found in order and recorded, the recorder should write on the front of the envelope the time your group took to complete the exploration.
   10. On the front of the envelope, beside your recorded time, have the recorder write one sentence from the group, to give the next group a clue for completing the exploration more quickly.
   11. Fold the map and put it inside the envelope. Then leave the envelope in your section.
   12. Your teacher will have your group trade sections with another group.
   13. Everyone in your group should choose a new role for each exploration.

14. Read the clue written on the envelope from the group before you. Do not look at the map inside the envelope.
15. Repeat steps 3-14 in order, until your group has completed four explorations. (Be sure to title your map with the correct exploration number.)
16. When all 4 explorations are complete, go back to your starting section and get the envelope that your group started with.
17. ***Record the data*** from all four explorations from the front of the envelope onto your Exploration Data Sheet.
18. With your group, compare the maps that were placed inside your envelope.
19. After collecting the data, ***study the data*** and ***draw conclusions*** by answering the questions following the Exploration Data Sheet.

    Using this information, ask students to determine if the data supports or refutes their hypothesis.

Conclusion

- Discuss the answers to the Those Who Have Come Before Me Student Section questions.
- Have the students update the LEARNED column in their KWL chart.
- Ask students to compare their individual data to the class data. What patterns can be found?
- Ask students "what they wonder now?" Encourage students to design their own experiments.

Assessment

- Assess student knowledge through questioning.
- Observe and assess student performance throughout the activity using the attached Scientific Investigation Rubric.

Activity Alignment to National Education Standards

National Science Education Standards (NSES):
Content Standard A: Science as Inquiry
- Abilities necessary to do scientific inquiry (K-8)
- Understandings about scientific inquiry (K-8)

Content Standard G: History and Nature of Science
- Science as a human endeavor (K-8)

National Council for Geographic Education (NCGE):
The World in Spatial Terms
- Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire process and report information.

Curriculum Explorations

To extend the concepts in this activity, the following explorations can be conducted:

Mathematics

Create a map of one of the exploration sections on graph paper. Use letters and numbers to identify the x- and y-axes. Write directions to guide another group to find all the hidden items located on the map using coordinates.

National Mathematics Education Standards (NCTM):

Geometry Standard:

- Specify locations and describe spatial relationships using coordinate geometry and other representational systems:
  - describe location and movement using common language and geometric vocabulary
  - make and use coordinate systems to specify locations and to describe paths

Language Arts

Ask students to explain the experiment. How might students improve this experiment? Where might there have been mistakes made? How might these mistakes have affected the results?

National Council of Teachers of English Standards (NCTE):

- Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.

Engineering and Technology

Discuss how technology builds on itself. For example, consider how transportation (airplanes, spaceflight, cars, etc.) has been improved based on the previous knowledge of researchers, engineers, and scientists.

National Science Education Standards (NSES):

Content Standard E: Science and Technology

- Abilities of technological design (K-8)
- Understanding about science and technology (K-8)
- Abilities to distinguish between natural objects and objects made by human (K-4)

Sources and Career Links

Thanks to subject matter experts Chris Giersch and Dr. Jennifer Rochlis for their contributions to KSNN™ and Noticiencias NASA™ on the development of this education material.

Chris Giersch is the Communications and Education Lead with the Exploration and Flight Projects Directorate at the NASA Langley Research Center.

Since 2000, Dr. Jennifer Rochlis has been working with the Robonaut project for the Automation, Robotics and Simulation division at the NASA Johnson Space Center (JSC) in Houston, TX. Dr. Rochlis has worked on projects while at JSC including developing the next generation Lunar/Martian rover, ground control of space station and space shuttle arms, KC-135 microgravity experiments for ergonomics evaluations, tile repair and educational outreach. You can read more about her work here: http://vesuvius.jsc.nasa.gov/er_er/html/robonaut/robonaut.html.

Lesson development by the NASA Johnson Space Center Human Health and Performance Education Outreach team.

Scientific Investigation Rubric

Experiment: THOSE WHO HAVE COME BEFORE ME

Student Name _____ Date _____

Performance Indicator	0	1	2	3	4
The student developed a clear and complete hypothesis.					
The student followed all lab safety rules and directions.					
The student followed the scientific method.					
The student recorded all data on the data sheet and drew a conclusion based on the data.					
The student asked engaging questions related to the study.					
The student can explain the importance of correct recording of findings for future exploration.					
Point Total					

Point total from above: _____ / (24 possible)

Grade for this investigation _____

Grading Scale:

A = 22 - 24 points

B = 19 - 21 points

C = 16 - 18 points

D = 13 - 15 points

F = 0 - 12 points