WHAT'S HIDDEN INSIDE?

Activity topic selected from NASA's KSNN™ 21st Century Explorer newsbreak "Why do robots travel places before people?"

Educator Section

Grade Level: 3-5

Connections to Curriculum: Science

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

Teacher Preparation Time: 10 minutes

Lesson Duration: 30 minutes

Prerequisite: none

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

Introduction

Why should robots travel places before people? Robots, sometimes called uncrewed space probes, are tools for astronauts and scientists to safely gather information about the planets and moons. Understanding and using this information helps scientists prepare astronauts for their trips into space.

Lesson Objective

In this lesson, students will gather information about items that they cannot see, using limited senses.

Problem

How can I determine what's hidden inside the bag?

Learning Objectives

The students will

- gather data through observations using their senses.
- make inferences about hidden items based upon data collected.
- develop a conclusion based upon the results of this activity.

Materials Required

tape

scissors

small paper bags

wooden skewers

safety glasses

NASA's KSNN™ 21st Century Explorer 30-second newsbreak – "Why do robots

Materials

- NASA's KSNN™ 21st Century Explorer 30-second newsbreak, "Why do robots travel places before people?" (Download the newsbreak at http://ksnn.larc.nasa.gov.)
- tape
- scissors

Per student

- 1 small paper bag prepared by a student before this activity
- 2 clues about the bag the student prepared for this activity
- 1 modified wooden skewer
- 1 pair of safety glasses
- What's Hidden Inside Student Section

Safety

Remind students about the importance of classroom and lab safety. Students should not taste any materials. Students should wear eye protection during this activity.

Pre-lesson Instructions

- Students should work in groups of 2.

The day before the lesson…

- Begin this study with a homework assignment. Give each student a small paper bag. Ask them to place a simple, common item in the bag, write their name on the bag, and fold the top of the bag down. Stress that students are to keep the contents of the bag a secret. Caution students not to put any breakable or sharp objects in the bag. The students should prepare 2 clues about the item hidden inside their bag.
    - Example of objects to hide in the bag: cup, marker, eraser, spoon, etc.
- You may want to prepare a few extra bags in case a student forgets to bring one.
- Modify the wooden skewers by cutting off the sharp tips.

The day of the lesson…

- Have a collection point for the students to place their bags when they enter the room.
- Double bag any heavy items.
- Tape the top of the bags closed.

Lesson Development

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

- Read NASA's KSNN™ 21st Century Explorer Web Text Explanation titled "Why do robots travel places before people?" at http://ksnn.larc.nasa.gov.
- Read the following text taken from the Observation Section of the What's Hidden Inside Student Section.

> ### Observation
> Why should robots travel places before people? Robots can be programmed to do amazing things, but they can only do what they have been programmed to do. Robots, sometimes called uncrewed space probes, are tools for astronauts and scientists to safely gather information about the planets and moons.
>
> Robots become a human's virtual eyes and ears in new places. They can observe from a distance. Some robots land, explore, and gather samples for close inspections. They search for sites for human landing and look for needed resources. Working together, astronauts and robots may make human space exploration more efficient.
>
> In this activity, you will try to identify what's been hidden inside a bag. Similar to robotic exploration, you will use limited senses to predict what's inside the bag.

- If needed, additional research can be done on the following science topics:
    - uncrewed space probes
    - robotics at NASA
    - robotic and human 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 "Why do robots travel places before people?" to engage students and increase student knowledge about this topic.

2. Remind students about properties such as weight, shape, texture, sound, odor, appearance, etc.
3. Review the problem with the students.
   Problem: How can I determine what's hidden inside the bag?
4. Have the students read the ***Observation*** Section in the What's Hidden Inside Student Section and discuss in their groups.
5. 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 What's Hidden Inside 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."
6. 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.
7. Students will ***test*** their hypothesis following this procedure.
   (The following steps are taken from the Student Section. Educator specific comments are in italics.)

   Mix up the bags and distribute a bag to each student, being careful not to give a student his/her own bag. Tell the students to handle the bags gently.

   1. Put on your safety glasses.

      Stress the importance of keeping eye protection on during this portion of the lesson.

   2. Your teacher will give one bag to each person. You will work with a partner.
   3. Brainstorm with your teacher and class what properties you can ***observe*** to find out what is in the bag. Record these properties under "The property I want to explore…" column of the Hidden Object Data Sheet.

      Brainstorm what senses to use to gather information about these properties, how to use their senses without opening the bag, and how these might help them discover what is in the bag. Some examples of properties might include: sound, odor, weight, size, shape, texture, etc. The students will record these properties in "The property I want to explore…" column. The remaining columns will be filled with observation data. An example of a student entry on the Hidden Objects Data Sheet may read:

Hidden Objects Data Sheet

Brainstorm Properties

The property I want to explore…	What I did to the bag…	What I discovered…	Predict what is in the bag…
shape	touched the outside of the bag	it has a tube shape	feather
weight	lifted the bag	heavier than a feather	pencil

   4. Use your senses to gather information about the properties of what's inside the bag. Investigate the properties that you listed in the data chart one at a time.
      - What did you do to the bag to observe the first property? Record these properties under the "What I did to the bag…" column of the Hidden Object Data Sheet. CAUTION: Handle bags gently.

- By testing this property, what did you discover about the hidden object? Record these properties under the "What I discovered…" column of the Hidden Object Data Sheet.
- Now, predict what you think is inside the bag and record your prediction under the "Predict what is in the bag…" column of the Hidden Object Data Sheet.

5. Your teacher will show you how to put a wooden skewer through the top of your bag. Use this skewer to gather more information about what's inside the bag and record on the data chart. This is called "extended touch". CAUTION: Only poke one small hole in the bag. Do not rip the bag.

   Give students the additional probing device; a modified wooden skewer (cut the sharp tip off). Show the students how to push the skewer through the top of the bag without tearing the bag. This is an "extended touch".

6. Share with other groups what you have done to your bag. If you discover new properties you would like to observe to find out what's inside the bag, record them under "The property I want to explore…" column for New Properties on the Hidden Object Data Sheet.

   Allow time for further investigation based on new information collected from other groups.

7. Use your senses to ***collect data*** about the new properties of what's inside the bag. Investigate the new properties that you listed in the data chart one at a time.
   - What did you do to the bag to observe the new property? ***Record*** these properties on the Hidden Object Data Sheet.
   - By testing this property, what did you discover about the hidden object? ***Record*** these properties on the Hidden Object Data Sheet.
   - Now, predict what you think is inside the bag and ***record*** your new prediction on the Hidden Object Data Sheet.
8. Find the person who made the bag you are investigating. That person will give you 2 clues about what's inside the bag. Record the clues on your Hidden Objects Data Sheet and again, predict what is inside the bag.
9. Based on data gathered in your data chart, make your final prediction about the item inside the bag. Be as detailed as possible. Record this final prediction on your Hidden Objects Data Sheet.
10. Open the bag to see what's inside. Is it what you predicted? Record the actual item on your Hidden Objects Data Sheet.
11. After recording all data, ***study the data*** and ***draw conclusions*** by answering the questions following the Hidden Objects Data Sheet.

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

Conclusion

- Discuss the answers to the What's Hidden Inside Student Section questions.
- Have the students update the LEARNED column in their KWL chart.
- 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)

Curriculum Explorations

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

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?

Have the students write a short description of what is in the bag without specifically stating what the object is. Then, have the student exchange the written statement with someone else to see if that person can guess what is in the bag by the written description?

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.

Sources and Career Links

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

Dr. Donald Strayer is a technical group leader for the Low Temperature Science & Engineering Group, Technical Monitor for ground-based investigations in the fundamental physics program at the NASA Jet Propulsion Laboratory. Find out more about his work here: http://www.jpl.nasa.gov/engineers_scientists/ here: http://funphysics.jpl.nasa.gov/technical/library/2002fps-conf/, and here: http://www.lpi.usra.edu/meetings/leag2005/pdf/2030.pdf.

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: WHAT'S HIDDEN INSIDE

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 used qualitative data collected to infer the unknown.					
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