What do you see?

Summary

The activity of creating a foam rocket and re-entry shield will give students a hands-on experience in the scientific process and increase their understanding of the solar system.

Group Size

Large Groups

Materials

- *Foam Rocket*
- *Test Stand*
- *Re-entry Shield*

Attaching the Shield
Pipe foam insulation
#64 rubber band
5/16 flat cut metal washer
Propane torch
Wooden dowel
Aluminum foil
Metal screen
Machine screw -- flat head
Machine screw nut
Washer
Hot glue gun
Fire extinguisher
Water
Safety glasses
Lighter

Additional Resources
Media
Beyond The Solar System- Expanding the Universe in the classroom, by Harvard-Smithsonian Center for Astrophysics; ISBN 0-9776402-0-5

Background for Teachers

This activity will take several days to complete. Students should have a good understanding of the progresses that have been made to help observe objects in space. Students should be familiar with the invention of the telescope and other important benchmarks in the history of science's dealing with space. This activity is designed to give students hands on experience in the scientific process. For this activity to be most beneficial, students should journal their experiences throughout the entire process. Students will be given several opportunities to show self differentiation in the creation of their foam rocket and re-entry shield. Students should have the feeling that they are actually creating important products that will help in the observation of objects in space.
Safety Statement: Request prior approval with administration. Conduct activity outside on a calm day, and store propane off school property or in an appropriate location.

Intended Learning Outcomes

1. Use science process and thinking skills.

2. Manifest scientific attitudes and interests.
3. Understand science concepts and principles.

Instructional Procedures

Invitation to Learn

Ask the students to get out of their seats and go to the back of the classroom. At the front of the room display an object that is big enough to be seen with the naked eye, but small enough to make it difficult to make out any real detailed features. On the object place some distinguishing marks or words. Ask the students to make observations of what they see. Ask the students if there are different ways they could observe this object that would help to identify it better. Tell the students when they return to their seats they will record in their journals what they saw and any ideas of how this observation could improve. Before having the students return to their seats, give one student a pair of binoculars to observe the object. Now have the students return to their seats and record their observations. Have a few students share their thoughts. Ask the student who observed the object with the binoculars to share. Ask the students which observation they trust the most and why.

Instructional Procedures

Students will be informed that the object that they observed during the "Invitation to Learn" is coming closer to Earth and scientists have determined that more information must be gathered about this object. Discuss with the students the idea that science's understanding of the solar system is determined by the technology used to investigate it. Tell the students that they have been chosen to create a rocket that will journey to this object with the purpose of gathering information.

Handout the materials that will be used to construct a rocket.

The student's assignment will be to get the rocket they have designed to travel as close to the unknown object as they can.

To create the unknown object the teacher will place a hula hoop some distance (at least 30 feet) from the students, the teacher will need to determine what distance would be appropriate. After the hula hoop has been placed, the teacher will scatter the contents of a puzzle that explains what the object is into the center of the hula hoop.

Students will launch their rockets towards the unknown object. Each student will walk to the spot where their rocket landed and take a digital photo of what they see. All of the student's photos will be downloaded to a computer for further observation.

The scientist have determined that more information must be gathered about the unknown object and so the student's rockets must be launched again with the purpose of landing and retrieving information from the object's surface and then returned safely to Earth.

The scientists feel the rockets the students have designed are great and that they are up to the assignment of getting to the unknown object and land. The problem the students are now faced with is designing a system that will be able to withstand the return trip through Earth's atmosphere.

Students will be given the materials needed to create a re-entry shield. The purpose of the shield is to protect the information gathered from the unknown object during re-entry. Teachers will need to create a test stand prior to this.

Students will launch their rocket towards the unknown object. If they land within three steps of the hula hoop they can gather one piece of the puzzle. If they land inside the hula hoop they can gather three pieces.

After each student has had the opportunity to gather pieces of the puzzle they will then make the attempt to bring the pieces back to Earth. Each student's shield will be exposed to the hostile experience of re-entry. Student's shields will be placed in the Test Stand to simulate the intense heat of re-entry. The students whose shields maintain protection for a preset amount of

time (teacher's choice) will be allowed to delivery their puzzle pieces to the scientists. If a shield does not withstand the re-entry those pieces are lost.
Students will help the scientist piece together the pieces that were returned to Earth with the purpose of identifying the unknown object.

Extensions

Curriculum Extensions/Adaptations/ Integration

Have students record and graph the timed results from the re- entry shield experiment.
Students may be assigned to those that may be challenge in the construction of the rocket or thermal shield.
Create small groups to work as teams instead of by themselves.

Family Connections

Students could take their foam rockets home and perform similar experiments with their families.
Students could talk with their parents about how they have observed objects in space.

Assessment Plan

Have students record the scientific process they experienced as they went through the creation process in a journal.
Have students reflect on the experience and share what they would have done differently and why.
Have students use the information gained from their first attempt at creating a re-entry shield to create a second shield.

Bibliography

Research Basis

Tomlinson, Carol Ann (2001). Differentiation of instruction in the elementary grades. ERIC Digest, Retrieved 11/27/07, from http://www.ericdigest.org/

At its most basic level, differentiation consists of the efforts of teachers to respond to variance among learners in the classroom. Whenever a teacher reaches out to an individual or small group to vary his or her teaching in order to create the best learning experience possible, that teacher is differentiating instruction.

Caine, R.N., & Caine, G. (1994). *Making connections: Teaching and the human brain*. Menlo Park, CA: Addison-Wesley.

Learning from classroom activities with application to real world situations are the lessons students seem to learn from and appreciate the most. Brain research shows the more senses used in instruction, the better learners will be able to remember, retrieve, and connect the information in their memories. "I hear and I forget; I see and I remember; I do and I understand." Students learn best when doing. By incorporating realistic, integrated, or interdisciplinary activities that build on established knowledge and skills and more than one sense, memory pathways become more accessible and cross- referenced for future use. As teachers discover the most effective strategies for better student achievement, they can adapt their lessons accordingly.

Authors

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