Activity 3: Spacecraft Design

Overview

In this activity, students are asked to apply the knowledge they've gained about Oobleck's properties to a design challenge. On paper, they design a spacecraft that is able to land on an ocean of Oobleck without sinking, collect a sample, and take off again with all passengers safely aboard—without getting stuck.

This activity serves several important purposes. It deepens student learning by motivating them to apply what they've learned so far in a new context—their close familiarity with the physical properties of Oobleck provides some of the parameters and constraints involved in the design challenge. At the same time, their creative problem-solving abilities come to the fore. Through their involvement in this challenge, they are directly engaged in activities that support the connection between science and technology. Technology, the use of scientific knowledge to propose new solutions to human problems, needs, and aspirations, and awareness of its advantages and limitations—is an important component of national and state standards.

Truth in science can be defined as the working hypothesis best suited to open the way to the next better one

*-- **Konrad Lorenz,** zoologist, behaviorist, Nobel Prize in medicine*

Several "Going Further" activities are suggested as strong extensions to this design activity. Depending on your time constraints, you may want to pursue one or more of the directions suggested.

Learning Objectives for Activity 3

- Involve students in a technological design challenge to deepen their understanding of properties and to apply that understanding in a new context.
- Contribute to student insight into the connections between science and technology.
- Foster student design and drawing abilities.
- Further develop science inquiry and language arts abilities connected to making models, critiquing, communicating, and explaining.

What You Need

For each student:

- ❑ 1 sheet of white paper (8 ½" x 11")
- ❑ felt-tipped markers, crayons, or colored pencils

For the whole group:

- ❑ 1 roll of masking tape

Getting Ready

On the board, write out any "Laws of Oobleck" that the students agreed upon in Activity 2.

Setting the Scene

1. **Tell students their next challenge is to design a spacecraft that is able to land on an ocean of Oobleck.** The craft has to be able to land without sinking, explore the moon, and take off again without getting stuck, with all passengers safely aboard.

2. **Explain that the moon has conditions very much like those on Earth (atmosphere, temperatures, etc.) except that the oceans are made of Oobleck.**

3. **Review the "Laws of Oobleck" that resulted from the scientific convention.** Tell the students that their designs must take these "laws" into account, along with any other observations they have made that they think are important to consider.

4. **Emphasize that the most important part of the assignment is to figure out how to build the spacecraft so it can land safely on the Oobleck and take off again.**

5. **Tell students to label those parts or features of their spacecraft that allow it to land and take off without sinking or getting stuck in the Oobleck.** As needed, they might also want to provide brief written explanatory notes for design features.

6. **Hand out paper and felt-tipped markers, crayons, or colored pencils so students can draw, color, and label their designs.** Tell students that they may work alone, or partner with one other student as a team.

7. **Let students get started on their designs.**

Do not give specific hints about how to design the spacecraft. With only the suggestions given here, students have come up with very creative engineering solutions to the Oobleck spacecraft problem. Some have designed landers with thousands of little feet that continuously press on the Oobleck so it stays solid. Others have used a hovercraft concept, high-speed cars, Oobleck dryers, or landing platforms with a detachable return shuttle.

Designing and Discussing Spacecraft

1. Circulate among the students as they work, asking them how their spacecraft will land on the Oobleck and take off again. Remind them to label their drawings.

2. Tell each individual or team to critique their own spacecraft, listing any advantages and drawbacks to their design.

3. Some classes finish their drawings in one 45-minute session. However, many classes require additional time during a second 45-minute session to complete their drawings. Some teachers assign the completion of drawings as homework.

4. When the students are finished, allow five or ten minutes for them to circulate to view each other's drawings.

5. Tell everyone to be seated and ask for volunteers to explain their drawings to the class. Invite one volunteer at a time to stand in front of the class, hold up her drawing, and explain how it will land on the Oobleck and take off again. Ask students to include in their report the advantages and drawbacks they noted in their design. Give everyone who wants to a chance to present to the group.

6. Wrap up the presentations by asking the students which designs they think are most likely to survive the trip to and back from the Oobleck ocean.

Students often get carried away creating their spacecraft, including elaborate features that have little or nothing to do with landing the craft, such as laser cannons, force fields, and convertible roofs. These features are okay, ***but you may have to remind your students several times that the object is to create a spacecraft that can land an and take off from an ocean of Oobleck without sinking or getting stuck.*** *This design challenge should be their first priority.*

Going Further

1. **Testing Spacecraft Ideas.** Following Activity 3, Spacecraft Design, provide students with an array of materials and fresh bowls of Oobleck to test their ideas about how to keep a spacecraft from getting stuck. You might provide different substances such as wood, metal, glass, plastic, and cardboard to see which ones float on the surface, which sink, and which ones stick to it. You could also provide springs for bouncing on the Oobleck, or rubber bands to see how much force is needed to pull a spacecraft off the surface. If your students become deeply involved in this activity, you might invite them to bring in materials from home.

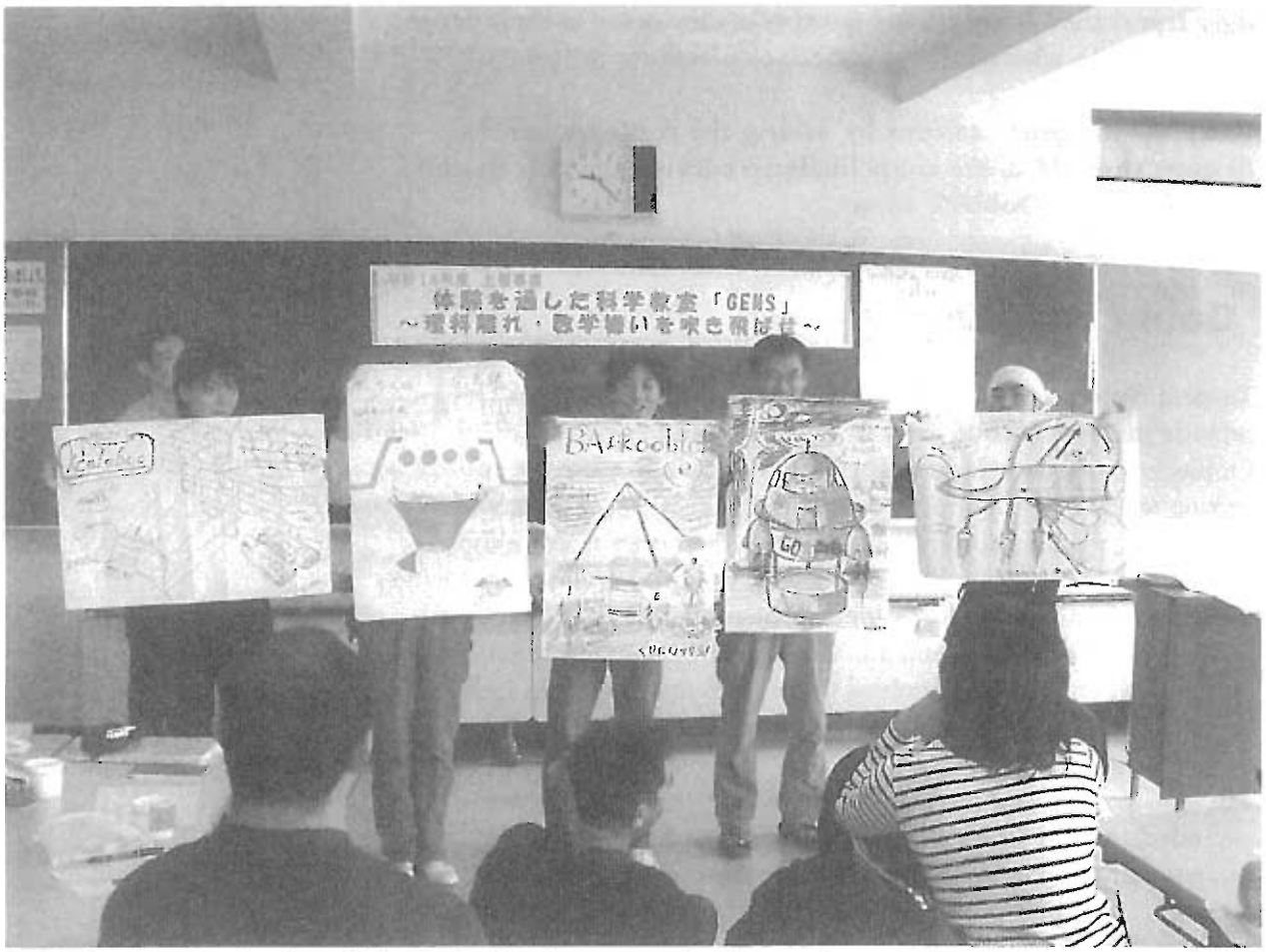
2. **Three-dimensional spacecraft models.** Many teachers have extended and built upon "the Oobleck experience" by having students actually construct landing crafts from various materials, such as straws, toothpicks, balloons, meat trays, paper, styrofoam cups, packing materials, etc. The crafts must be able to land on and sit

upon a large tray/pan of Oobleck for five seconds, and then be able to "take off" (be lifted off) without sinking or getting stuck in the Oobleck. This is a great activity and has resulted in many ingenious models.

3. **Oobleck at Home.** Explain to the students how they can make Oobleck at home. Tell them to put one cup of water in a bowl, and add about 5 drops of food coloring. Add most of one box of cornstarch, sprinkling it in little by little, mixing until it feels like the substance they used in class. If it is too soupy, they should add a little more cornstarch. Of course, remind them about cleanup precautions and methods.

4. **Oobleck Sci-Fi:** Ask your students to make up stories about creatures who live on the moon with the green Oobleck oceans. How does Oobleck affect the weather systems? How do these creatures survive if they fall into the ocean? What do they eat? What do they look like? What are some of their social customs? How might they respond to visitors from Earth?

In the GEMS unit Moons of Jupiter, *for grades 4–8, students re-create Galileo's historic observations of Jupiter's moons, through viewing images provided with the guide. They also do cratering experiments, make a scale model of the Jupiter system, and go on a "grand tour" of the four main moons. In the final activity, teams of students build model settlements on one of the moons.* Moons of Jupiter *is an excellent companion unit to* Oobleck, *as are the GEMS units* Earth, Moon, and Stars *and* Messages from Space.



Some land-on-and-take-off-from-Oobleck spacecraft designs from Japan.