



Assignment Discovery Lesson Plan Unsafe Waters

Subject

Technology

Grade level

6-8

Duration

Three class periods

Objectives

Students will

- discuss the challenges of deep-sea exploration;
- work in groups to research deep submergence vehicles; and
- create a “deep-sea exploration” mural showing a variety of submersibles at different depths and their uses.

Materials

- Computer with Internet access
- Print resources about deep-sea exploration
- Plain white paper
- Markers, glue, scissors, poster board, paint, and other art materials
- String

Procedures

1. Before you begin this lesson, set up the framework for the deep-sea exploration mural on the classroom bulletin board. Draw the ocean bottom (with peaks and trenches) and the ocean surface, with plenty of room in between. Then divide the ocean into equally spaced levels, marking each depth in 1,000-meter increments—1,000 meters, 2,000 meters, etc. (If you decide not to make a full mural, you could draw a temporary graph to represent the ocean on the board.)
2. After watching the video, ask students to discuss some of the challenges of deep-sea exploration. What conditions make deep-sea exploration so difficult? (*It’s very cold, almost completely dark, and at extremely high pressures.*)

3. Explain that for these reasons, divers can only descend to certain depths. The deepest a scuba diver has gone is 145 meters. Even with a special diving suit, such as the "Jim Suit," explorers can only reach 600 meters. (You may want to mark or write these depths on your mural.)
4. Now, set the scene for investigating today's deep-sea submersibles. Tell students: The first vehicle to carry explorers to great depths was the bathysphere. First used in 1934, this round, steel chamber was attached to a ship by a long cable. In its first dive, the bathysphere reached a depth of about 1,000 meters. (At this point, mark the bathysphere on your mural.) The next great invention in deep-sea submersibles was the bathyscaphe—this vessel, which could be navigated on its own, was able to reach greater depths. One of the first and most famous bathyscaphes was Trieste.
5. Tell students that they are going to work in pairs to research Trieste and other deep-sea submersibles. First, they will record important facts about the vessel on their "fact sheet." Then, they'll create a drawing of it. Finally, all the fact sheets and drawings will be placed on the mural, showing the greatest depth to which each vessel can descend.
6. Next, assign pairs of students to one of the following submersibles:
 - Alvin
 - Argo II
 - Dolphin 3K
 - DSL-120A
 - JASON
 - Kaiko
 - Nautilie
 - Sea Link,
 - Shinkai 6500
 - Trieste
7. Have students research their submersible, gathering the information below. Tell them they must include this info. on their fact sheets under the submersible's name. Encourage students to print out or sketch pictures of the submersible to help with their final drawing.
 - Greatest depth to which it can descend
 - Inventor's name and year it was invented
 - Number of persons it can carry (if any)
 - Length
 - What sets it apart from other submersibles
 - Country who owns or operates it
 - Type of data the submersible collects
 - Type of technology used aboard it
 - At least one major discovery accomplished with it
8. Have students use print and online resources in their research. These Web sites are good starting points.

- Woods Hole Oceanographic Institution: Deep Submergence Vehicles
Vehicles: ALVIN, JASON II, Argo II, DSL-120A
<http://www.whoi.edu/marops/vehicles/index.html>
 - Smithsonian Ocean Planet: How Deep Can they Go?
Vehicles: Sea Link, Alvin, JASON, Shinkai, Trieste
http://seawifs.gsfc.nasa.gov/OCEAN_PLANET/HTML/oceanography_how_deep.html
 - Dive and Discover: Expeditions to the Seafloor
Vehicles: DSV Alvin, DSL-120, JASON, Argo II
http://www.divediscover.whoi.edu/cruise7/about/tools_main.html
 - Deep Submergence Vehicles
Vehicles: Trieste, Alvin
<http://www.fas.org/man/dod-101/sys/ship/dsv.htm>
 - JAMSTEC (Japan Marine Science and Technology Center): Ships and Vehicles
Vehicles: Shinkai 6500, Dolphin 3K, Kaiko
<http://www.jamstec.go.jp/jamstec-e/ships.html>
 - AMNH Expeditions: Black Smokers: Underwater Tools
Vehicles: ALVIN, JASON
http://www.amnh.org/nationalcenter/expeditions/blacksmokers/water_tools.html
 - Voyage to the Deep: Alvin
<http://www.ocean.udel.edu/deepsea/level-2/mission/alvin.html>
 - BBC: Nautilie
<http://news.bbc.co.uk/2/hi/europe/2536339.stm>
 - IFREMER (French Research Institute for Exploitation of the Sea): Nautilie
http://www.ifremer.fr/fleet/systemes_sm/engins/nautilie/nautilie.htm
 - PBS: Trieste
<http://www.pbs.org/wnet/savage seas/deep-side-journey.html>
 - Margate Public Library: Submersible Links
<http://www.margatelibrary.org/submersibles.htm>
9. Once students have completed their initial research, give them a full class period to create their vehicle fact sheets and drawings. (Limit the height and width of their drawings to six inches.)
10. Have students attach their drawing to the deep-sea mural at the appropriate depth. Then, have them mount their fact sheet nearby and connect it to their drawing with a piece of string.

Extensions

- Divide the class into two groups. Ask one group to brainstorm ways that water is important to people everyday and the other to brainstorm ways that water is important to the planet as a whole. Then, have students write imaginary scenarios about what the world would be like without water.
- Challenge the class to create their own Jellyfish Jumble game. Have each student write down one surprising or amazing fact they learned about jellyfish

in the video. (They may also want to research more great facts in books or online. Yahoo!igans has a good collection of jellyfish links at: [http://www.yahooligans.com/Science and Nature/Living Things/Animals/Invertebrates/Cnidaria/Jellyfish/.](http://www.yahooligans.com/Science_and_Nature/Living_Things/Animals/Invertebrates/Cnidaria/Jellyfish/)) Next, ask each student to turn the fact into a fill-in-the-blank question. Under their question, they should write the answer along with a version of the answer where the letters are jumbled. For example: A jellyfish has no _____. (ESLTOKNE) (The answer is "skeleton.") Collect and review the student jumbles and compile them in a worksheet. Hand out the Jellyfish Jumble for a fun assessment of what they've learned.

- As a class, discuss some of the ways that humans are hurting our planet's water, such as dumping industrial waste or using pesticides. Then, have students work in small groups to create posters that promote ways to help protect Earth's water. For example, "Don't Litter – it ends up in our rivers and waterways!" Hang the posters around school to spread the message.

Evaluation

Use the following three-point rubric to evaluate students' work during this lesson.

3 points: Students were highly engaged in class discussions; showed thorough research on their deep-sea submersible; created a complete report including all of the requested information; created a clear drawing of their submersible with several details.

2 points: Students participated in class discussions; showed satisfactory research on their deep-sea submersible; created an adequate report including most of the requested information; created a clear drawing of their submersible with some detail.

1 point: Students participated minimally in class discussions; showed minimal research on their deep-sea submersible; created an incomplete report with little or none of the requested information; created a vague, simplistic drawing of their submersible with no detail.

Vocabulary

aquanaut

Definition: An underwater explorer

Context: In order to descend to great depths, aquanauts must ride in a deep-sea submersible.

bathyscaphe

Definition: A submersible vehicle used to explore the deep sea and carry scientists to the ocean floor

Context: The bathyscaphe was the first submersible that could be navigated on its own.

bathyspheres

Definition: An early sea exploration vehicle with a steel sphere that could be raised and lowered by a cable attached to a ship

Context: Introduced in 1934, the bathysphere was the first vehicle to carry explorers to great depths.

remotely operated vehicles (ROV)

Definition: A robotic submersible navigated by a person outside the vehicle

Context: Because ROVs do not carry people, they can descend to great depths and remain there for a long time.

submersible

Definition: A vehicle designed to descend and travel far below the ocean surface

Context: Submersibles can descend to much greater depths than submarines.

Academic Standards

This lesson plan addresses the following science education standards created by the National Academy of Sciences:

- Science and Technology: Abilities of technological design, Understandings about science and technology
- History and Nature of Science: Science as a human endeavor

Credit

Joy Brewster, curriculum writer, editor, and consultant