ocean explorer
oceanexplorer.noaa.gov

Mountains in the Sea Exploration

Journey to the Unknown

Focus
Ocean Exploration

Grade Level
5-6

Focus Question
What information can you use to determine where you are in an unknown area?

Learning Objectives
Students will experience the excitement of discovery and problem-solving to learn what organisms could live in extreme environments in the deep ocean.

Students will understand the importance of ocean exploration.

Adaptations for Deaf Students
Vocabulary:
- Be sure to pre-teach all vocabulary.
- Additional words: Realm and Exploration

Pre-Teaching Activity:
- Use Extension #2 to lead into this lesson.

Learning Procedure Section:
- Eliminate Step 1.
- Step 3 is optional, depending on hearing levels of students.
- Have the entire class work as one team during the "Why Do We Explore?" activity.

Materials
- ❒ NOAA and Woods Hole Oceanographic Institute (WHOI) photos of deep sea animals (See www.atlantisforce.org/canylife.html. Other useful deep-sea animal pictures can be found at http://extremescience.com/deepcreat.htm http://tqjunior.thinkquest.org/4106, and http://www.ocean.udel.edu/deepsea/gallery/gallery.html
- ❒ WHOI Posters of Deep Sea Sites (optional)
- ❒ Octacoral photos (www.oceanexplorer.noaa.gov and www.atlantisforce.org)
- ❒ Diagram/photo of ALVIN
- ❒ Audiotape or CD of mysterious music and engine sounds
- ❒ One pint Ziploc bag of sand
- ❒ One pint Ziploc bag of mud
- ❒ Deep East Voyage of Discovery Information Sheets from Ocean Explorer web site
- ❒ Student Data Sheet – 1 per student for use with Extension #2
- ❒ Why Do We Explore? Student Sheet (1 per group of 3-4 students)

Audio/Visual Equipment
- ❒ Cassette tape player, CD player, or computer with CD drive

Teaching Time
Two periods of 45 minutes each

Seating Arrangement
Groups of 3 or 4 students

Maximum Number of Students
30 students

Key Words
Explore
Technology

Submersible
Biodiversity
Manipulator arm
Manipulator claw
View port
Quadrat
Transect
Core sample
Tube corer
Sample basket
Sediment

Background Information

Today, we have sophisticated technologies that make the ocean more "visible" and more accessible than it has ever been before. As a result of "new technological eyes," hundreds of new species and new ecosystems have been discovered—some of which may hold the keys to the origin of life on Earth, cures for life-threatening diseases, and knowledge about presently unknown metabolic pathways for obtaining and using energy to support life here on Earth.

Even though we live on an Ocean Planet, more than two-thirds of which is covered by water, approximately 95% of the ocean remains unexplored. Recent progress in technology permits us to completely rethink how we conduct exploration and oceanographic studies. Developments in biotechnology, sensors, telemetry, power sources, microcomputers, and materials science now permit the U.S. to dream of rivaling space exploration in our ability to go to and study the undersea frontier. We need not be limited by weather and blind sampling from ships, but like the true explorers, can immerse ourselves in new places and events. The National Oceanographic and Atmospheric Administration (NOAA) has embarked on a national endeavor, to build on our initial exploration programs outside of NOAA, and to achieve international leadership in undersea exploration and research.

Learning Procedure

1. Have students close their eyes.
2. Tell them that they are going on an expedition.
3. Turn on a tape or CD player with a tape or CD of recorded mysterious music, engine, and underwater sounds.
4. Describe an actual ALVIN dive without saying that you are going underwater, as described in a.- n. below. Do not read the words in parentheses.
   a. You are a scientist on a mission.
   b. You enter a small vehicle with three seats in a small cramped area.
   c. You settle yourself into the seat on the right side of the vehicle.
   d. Engines begin to whir as your vehicle slowly begins to move forward, rocking gently, and you begin to enter another realm. It sounds similar to an outboard motor in the water.
   e. You hear the whine of thrusters begin. The pilot switches on buttons and you're off! The vehicle's tanks begin to fill and other engines start. You hear the pilot talking to the mother ship. She is communicating your vehicle's direction and her observations. "I have a heading of 030. I see many creatures. It is getting darker and I am switching on the outside lights." Several hours later, you begin closing in on your destination.
   f. The interior and exterior cameras are frantically switched on as new and amazing objects and organisms whiz by.
   g. You are fascinated by the array of things you can see from your viewing port.
   h. Suddenly, a glowing object moves past. "WHAT WAS THAT???" *(Bioluminescent fish or other organisms.)* It seems to be following another object. It moves out of your range of viewing. You busily begin speaking into your recorder to excitedly record every amazing sight that you see in detail.
   i. You see that your vessel is settling onto a surface and you begin to observe objects there. Large branching objects come into view. You request that the pilot collect a few of these with the claw or the manipulative arm and put them into the sample basket. (*Deep sea corals*)
   j. Farther ahead, you see something interesting scurry into the mud. "Pilot," you say, "Quick!

Take a core sample seven meters ahead! Things are moving in the mud!" *(Polychaete worms)*

k. Slowly, she lowers the tube corer to the surface. She uses the manipulative arm to press it about 30 centimeters into the surface. Then she pulls it up and returns it to the quiver where it was stored. It looks like an interesting core sample!

l. Your attention is caught by a dial on the control panel. It reads 2000 meters! It is incredible that the bottom is covered with animals, tracks, and holes.

m. The captain deploys a video camera and records what you are seeing.

n. All too soon, the pilot indicates that it is time to return to the mother ship. You ascend slowly, totally amazed by what you have seen through your viewport—things that you have never seen before in your entire life. You cannnot wait to begin analyzing and observing the new sediments and species that have been collected for your research project.

5. Have students open their eyes and have a discussion about where they think that they have been and why? Stimulate the discussion by asking the following:
   Were you excited? Why was it dark?
   What was the glowing object? The branching objects?
   What were the things moving in the mud?
   What was the dial that read 2000 meters?
   What were you thinking as the vessel moved around?
   Would you have been frightened if you had actually been on board?
   Do you think that scientists get excited when they are making discoveries?
6. Tell your students that you are going to provide them with some materials to help them try to determine where they went on their imaginary voyage. Give each table copies of several photos of deep sea creatures, a picture of ALVIN, a Ziploc bag full of sand and one of mud. (Do not explain the materials yet.) Tell the students to think about the things that they saw and heard, including the pilot's words. Give them 10-15 minutes to explore, discuss, ask questions.
7. As a class, have students discuss their ideas, answering questions, and challenging ideas. Then tell them that they were on an imaginary trip aboard a deep-sea submersible and now they are going to learn about places being visited by the Woods Hole Oceanographic Institute's submersible, ALVIN. Tell the students that they will be able to collect data, see pictures, and communicate with the people on ALVIN. Bring out Woods Hole posters of deep sea sites. Discuss the Deep East Voyage of Exploration and why it is important.
8. Play the Why Do We Explore game? (See attached activity adapted from NASA's Destination to Mars)

The BRIDGE Connection

www.vims.edu/bridge

Choose Elementary from sidebar, then 5th Grade, and then Ocean Planet: Interdisciplinary Marine Science Activities

The "Me" Connection

Have a discussion of products from the sea, potential to discover new species, new medicines, and new ways of transferring energy. (Use www.ohia.com and www.coralreefalliance.org/aboutcoralreefs Web sites from Resources section.)

Connections to Other Subjects

Biology, English/Language Arts, Mathematics

Evaluation

Have students write a log entry with illustrations about what was seen on the deep sea dive. Ask them to include the newly-learned vocabulary terms in their entry.

Extensions

1. Science - Research the Internet to find more species that live at depths of 2,000 meters and beyond. Make a poster using the information about a particular animal and share posters with classmates.

2. **Science** - Conduct a simulated deep ocean bottom exploration on the playground or other outside location. Have students pretend that they are exploring it for the first time. Have them make quadrats using meter sticks taped together to form square quadrats. Hula hoops work well as circular quadrats. Have them draw their entire quadrat and record observations of both living and nonliving components on the Student Data Sheet using a transect, or line across the quadrat.
3. **Language Arts and Science** - Read a book or research the Internet for information about deep sea life.
4. **Language Arts** - Write your own captain's log about diving to the depths of the ocean and returning to the surface.

Resources

www.oceanexplorer.noaa.gov

Ocean Exploration Information Sheet – Attached

www.ohia.com/ohia/roadshows/ocean/ocean/ocean.htm

www.coralreefalliance.org/aboutcoralreefs

"Coral Reef Information" links

National Science Education Standards

Content Standard A: Science As Inquiry

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Content Standard G: History and Nature of Science

- Science as a human endeavor
- Nature of Science
- History of Science

For More Information

Paula Keener-Chavis, National Education Coordinator/Marine Biologist
NOAA Office of Exploration
2234 South Hobson Avenue
Charleston, SC 29405-2413
843.740.1338
843.740.1329 (fax)
paula.keener-chavis@noaa.gov

Acknowledgements

This lesson plan was produced by Robin Rutherford and Jane Settle, Porter Gaud School, Charleston, SC for the National Oceanic and Atmospheric Administration. If reproducing this lesson, please cite NOAA as the source, and provide the following URL:
http://oceanexplorer.noaa.gov

Student Handout

Student Data Sheet
(Use with Science Extension 2)

Quadrat No._____
Transect No._____

Animals		Plants		Burrows & Mounds		
Description	No.	Description	No.	Description	No.	Soil Description

Many scientists, including those that use the ALVIN to explore the deep ocean, use quadrats as tools for quantifying organisms. Do you think this is a good method? Why or why not?

Student Handout

Why Do We Explore?!?!?!

(Adapted from NASA's Destination to Mars)

About This Lesson

Students will work in small teams, each of which will be given a different reason why humans explore. Each team will select one reason for exploring as a group and will become experts on their chosen reason. The team will add a letter and summary sentence to an EXPLORE poster using their reason for exploration. With all the reasons on the poster, the word EXPLORE will be complete. Students will be using the skills of working in cooperative learning teams, reading, summarizing, paraphrasing, and creating a sentence that will best represent their reason for exploration. Students will also be illustrating and copying other teams' sentences so that each student will have a small copy of the large classroom poster for reference or extension purposes.

Objectives

Students will:

Review the seven traditional reasons why people explore.

Write a summary of their reason why humans explore.

Illustrate their exploration summaries.

Relate the reasons for exploration to the Mountains in teh Sea: Exploring the New England Seamount Chain Expedition.

Background

Students do not always realize that the steps in future exploration are built on a tradition of exploration that is as old as humans. This lesson is intended to introduce the concept of exploration through the seven traditional reasons that express why humans have always been explorers. Social scientists know that everyone, no matter how young or old, is constantly exploring the world and how it works. Deep sea technologies have opened an entire new world for us to explore. It is essential that students understand the traditional reasons why humans are reaching beyond the land on which we live to the deep ocean and why continued exploration is important. Students will be able to make informed decisions regarding exploration and the future of our planet only if they understand that our future as explorers holds its foundations in our past and in our very nature as human beings.

Seven Reasons for Exploring

1. People are curious.
2. Exploration looks ahead, not behind.
3. Leaders in exploration are leaders in the world.
4. New places can be helpful because they have raw materials and natural resources.
5. Exploration helps us understand our place in the universe.
6. Exploration opens up new places.
7. Humans love adventure and exploring new places is the best kind of adventure.

Additional Resources

NOAA Deep East Voyage of Discovery
www.oceanexplorer.noaa.gov/explorations/deepeast01/deepeast01.html

History of ALVIN
http://www.marine.whoi.edu/ships/alvin/alvin_history/alvin_history.htm

Voyage to the Deep
http://www.ocean.udel.edu/deepsea/level-1/creature/creature.html

Extreme Science
http://www.extremescience.com/deepcreat5.htm

Deep Sea Pages
www.bmi.net/yancey/

Student Handout

Materials

- ❒ One large piece of butcher paper or art paper
- ❒ One set of large cut letters E-X-P-L-O-R-E
- ❒ Tall sentence strips or sturdy pieces of paper cut to fit the poster (one per team)
- ❒ E-X-P-L-O-R-E paragraphs, one per group
- ❒ Tape
- ❒ Pencils
- ❒ Markers
- ❒ Paper
- ❒ Student Sheet, *Why Do We Explore?* (1 per group of 3-4 students)

Procedure

Advance Preparation

1. Read background and additional resource materials as necessary.
2. Make the poster by placing letters vertically on large butcher paper, spelling E-X-P-L-O-R-E. Laminate if possible for reuse.
3. Duplicate the handouts.
4. Prepare for seven teams.
5. Divide students into seven teams.

Classroom Procedure

1. Explain to the students that all humans are explorers, including each one of them.
2. Give each team a set of materials and the handout for their team.
3. Read the introduction on the top of the Student Sheet – *Why Do We Explore?* to the students.
4. Have the students read about the traditional reason for exploration given to their team.
5. Have the students, as a group, write a sentence that best explains or summarizes their team's reason for exploring. The team's sentence must begin with the letter assigned to the team.
6. Ask each team to brainstorm to decide on and draw an illustration for their sentence.
7. Have each team copy their sentence and illustration onto a sentence strip.
8. Instruct each member of the team to copy the team's sentence and illustration on the paper provided so that each student has a copy.
9. The members of the team will place their sentence strip on the large poster and explain their sentence and illustration to the rest of the class.
10. Each student will copy the other teams' sentences onto their own paper so that they each will have a mini-poster when the exercise is completed. The mini-posters can be used for closure, extensions, writing prompts, review sheets for testing, and/or making other connections to deep ocean exploration.
11. Lead a discussion that connects the historical reasons for exploration with the desire to explore the deep ocean, using robots and submarines.

Student Handout

"Why Do We Explore?"

Whether we know it or not, we are natural-born explorers. There are many reasons why we explore. From birth we learn about life and how it works by exploring. No one can be satisfied for very long without exploring. Whether you are talking to someone next to you or looking around the room, you are exploring!

Directions:

1. You and your partners are constructing the EXPLORE poster on the wall.
2. Each team has a paragraph indicating one of the seven different reasons why humans explore.
3. At the beginning of the paragraph there is a letter designated for your team. You will use this letter to start a sentence that summarizes your team's reason for exploring.
4. Think of a sentence that describes the ideas from your paragraph. It has to begin with the letter listed on the top of your paragraph. Write the sentence on the sentence strip.
5. Make an illustration to go with your sentence and put it on the sentence strip. Be creative in your use of color.
6. Each student should make a copy of your team's sentence and illustration on the paper provided.
7. Place your team's sentence and illustration on the poster and discuss them with the class.
8. Copy each team's sentence and illustration as they, in turn, add them to the poster.

Student Handout

Your team has the letter "E"

People are curious about everything. We learn something new every day. If you get bored, you automatically look for something to do. That is the way we are. We like to learn new things. We also like to understand things and how they work. From the time you were born, you have been finding out how things work by exploring them. Curiosity makes us Explorers.

Your team has the letter "X"

Exploration looks ahead, not behind. We do not want to be stuck in the past. We want to move ahead. Exploration gives us the sense that anything is possible. Exploration leads to knowledge and understanding, and that means you make the world a better place as you explore. People have always tried to leave the world a better place for future generations. Exploration is one way we can do that. It is a gift that people of the past give people of the future. (You may use X or some other letter to start your sentence.)

Your team has the letter "P"

Leaders in deep ocean exploration are leaders in the world. The countries that join together to go to the deep ocean will find new ways of working together and sharing their successes. Working together on major projects in the deep ocean environment will help make nations on Earth more peaceful. Anytime you have to work with others, you learn about them and yourself. Working together with common goals helps people understand each other. It is very hard to go to war with people you understand. Working together also makes us more creative.

Your team has the letter "L"

New places can be helpful to us because they have raw materials and natural resources. If we are going to explore the deep ocean, it can help our economy. Deep ocean exploration creates jobs and technology that make our world better. The deep ocean might have products and materials that are not available on land. We could also look for new; cleaner energy sources in the deep ocean that might help protect our environment.

Student Handout

Your team has the letter "O"

Exploration helps us understand our place in the universe. What might we find out about the deep ocean that helps us better understand life on land? If there are as yet undiscovered species, what can we learn from them? What useful products might they yield? Might living under the ocean become necessary at some time in the future? What we find in the deep ocean could be the greatest discovery of all time.

Your team has the letter "R"

Exploration opens up new places. Our country was once called the "New World" because the people of Europe discovered it when they thought only an ocean existed here. Europeans moved to the "New World," called it America, and we became our own country. We know no new lands exist on Earth to be discovered, so we look to the deep ocean.

Your team has the letter "E"

We love adventure and when we explore new places, it is the best kind of adventure. Landing on the floor of the deep ocean in a video game is not nearly as exciting as going there in person. Americans love adventure. From the time of the first colonies in America, we have spread across this great land and have loved the fun of discovering new things. We have landed on our own Moon and sent spacecraft to the far reaches of the solar system. When humans explore, we make the universe our classroom for learning.

Adapted from:

Destination: Mars 10/97 NASA JSC