OCEAN EXPLORERS: TEACHER GUIDE

Subject: Earth Science
Grade Level: Middle School
Last Updated: July 31, 2007

Case Summary

Ever wonder what it would be like to travel along the ocean floor? The Office of Ocean Exploration is seeking new teams of scientists and explorers to help find new possible mining locations in the Atlantic and Pacific Oceans. Join us for Ocean Training and learn about how you can be part of this important mission to the ocean floor.

Credits

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Learning Objectives

At the end of the case students will be able to:

1. List and describe the various features of the ocean floor (continental shelf, continental slope, seamounts, abyssal plain, mid-ocean ridge, trench, hydrothermal vents)
2. List and explain the different methods of ocean exploration, including the pros and cons of each (sonar, scuba diving, submarine, remote underwater manipulator/robots)
3. Identify different species of animals that live in the ocean and under what conditions they live (depth, light, pressure, etc.)
4. Describe minerals that are found in the ocean and where they are located
5. Examine and discuss the pollution risks that mining in the ocean poses

Georgia Performance Standards

E6E3. Students will recognize the significant role of water in earth processes
S6E5. Students will investigate the scientific view of how the earth's surface is formed
S6CS1. Importance of curiosity, honesty, openness, skepticism, etc.
S6CS6. Communication
S6CS7. Question scientific claims/ arguments effectively
S6CS9. Scientific inquiry

Assessment

Students will be assessed on completion of a box plot, a plotting worksheet as well as on completion of a final project including a brainstorming chart. For the final product, groups will be assigned to one of four projects. One option is a skit and the other three are PowerPoint presentations about ocean mining from different perspectives.

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Implementation Strategy

Case will take place over the course of five 60-minute class sessions. Students will work in groups of 4-5 to work through the case. During the case teacher/facilitator will move around the groups to check progress and assist students with any difficulties that arise.

Day 1: (60 minutes total)
- Read through Scene 1
- Complete box chart
- Share and discuss as a class

Day 2: (60 minutes total)
- Review case from previous class
- Hand out list of learning issues (found below in resources, the learning issues that were generated by all classes)
- Divide learning issues among group members
- Research learning issues using resources brought into the class
- Media Center: research learning issues not addressed by resources in the classroom

Day 3: (60 minutes total)
- Research learning issues using resources brought into the class
- Media Center: research learning issues not addressed by resources in the classroom

Day 4: (60 minutes total)
- Share and discuss findings from learning issue research, within group and as a class
- Read Scene 2
- Complete worksheet graphing and labeling ocean floor

Due to time constraints, we dropped Scene 3

Day 5: (60 minutes total)
- Overview of products, assign products to groups
- Divide up contributions to final product among group members
- Complete brainstorming chart
- Begin working on presentation products
- Media Center: continue research if necessary

Day 6: (60 minutes total)
- Work on final product

Day 7: (60 minutes total)
- Present product to class
- Complete self/group evaluation

Case Notes

Providing the students with a list of learning issues definitely facilitates research and putting together their final product. However, more thought needs to go into creating their product. Some of the learning issues that were included in the list were not relevant to the task, but were questions that were raised by the students. Facilitators need to help students evaluate what is important information to include in their presentations instead of making a PowerPoint slide for every single LI, relevant or not.

The graphing exercise, while taken from their textbook, was above the level of the students. Most students spent the entire class time figuring out how to label and mark the axes. Either the graph could be labeled beforehand, or the teacher could work with some of the other teachers to make sure students have been familiarized with graphing. The activity is quite good, the students who did complete the graph performed the best on the quiz that they had at the end of the section.

Students really need to be forced to share their information with one another in the group. Often they are completing their own LIs and never getting the other LIs, which is critical to learning all the information.

Facilitator Guide:
Scenes with key concepts underlined

Ocean Explorers: Scene 1

It was the last day of school and all the students were ready to leave as soon as the last bell rang. RRRIIINNNGGG. There it was. All the students filed out of the school and began talking about what they were going to do for the summer.

"Hey, John. What are you doing this summer?" asked Monica.

"Not sure. Probably hanging out, playing basketball," replied John. "Why, what are you doing?"

"Well, I saw this flyer hanging up in the hallway and I think it would be a lot of fun to do. Check it out." Monica shows the poster to John.

WANTED: OCEAN EXPLORERS

The Office of Ocean Exploration is seeking new teams of scientists and explorers to assist in deep sea exploration of the ocean floor. Teams are being sent out to find new possible mining locations along the Mid-Ocean Ridge and the Pacific coast. Interested individuals should report to Ocean Training on XXX, XX 200X.

"That sounds cool. I learned about the Mid-Ocean Ridge in my class last year. Isn't it in the Atlantic Ocean?" John asks. John is in 7th grade and had Earth Science the previous year when he was in 6th grade.

"I don't know," Monica replied. "We haven't talked about that. Why would they be mining in the ocean? What's down there? And isn't mining destructive? I read an article in the Canadian Press that says mining in the ocean will cause a lot of damage."

"Not a clue about mining for minerals and what it may do to the ocean, but I know that there are some really cool animals – squids, worms, and this awesome fish, the Fangtooth!" John really enjoyed learning about the different species that lived in the ocean.

"The Fangtooth? I wanna see that! Think that we would see it if we went on the ocean trip?"

"Not sure, there isn't any light down there…"

"How far down is it?" Monica asks nervously. She isn't so sure about being somewhere that is completely dark.

"I don't remember. But you know that it isn't flat down there, don't you? It's kinda like on land, there are all sorts of hills, valleys, and mountains, but that isn't what they are called. I'm sure that the Exploration Team would have some sort of lights on so that they wouldn't run into things. Otherwise, how do they know where they are? If we go to the training they would probably tell us all about it."

"You are probably right. I am still a little worried about how mining may hurt the animals down there, but I suppose if we go to the training we can ask them about it." Monica and John agree to go to the Ocean Training the next day.

Ocean Explorers: Scene 2

Students are receive a chart of longitudes and depth measurements and must plot the ocean depth. The graph paper is provided, but they must label the axes and other features. There are also a couple of other questions at the bottom of the page to answer.

Ocean Explorers: Scene 3

"It has been a long week, hasn't it?" Monica asks John.

"Sure has. We learned so much about what is in the ocean, and now I am ready to go and see it myself!" John was excited to set out on an exploration.

"I know, the class has been really cool," Monica agreed. "But I am still unsure about the mining. Did you notice that they didn't really talk about that at all? They just told us that you can find some minerals around by the hydrothermal vents."

"Don't you think that we need to start looking in the ocean for resources?" John asked Monica. "We have used so much of the land and the ocean is *huge*. Some places have found gold, copper, silver and zinc. These are things that everyone keeps needing."

"I'm not so sure about that," Monica argued. "For instance, why do we need more gold? It's just material items, like these earrings, that people could learn to live without."

"Well, that isn't necessarily true," John responded. "We use these minerals for many other things than just rings and necklaces. Plus, it is easier to mine in the ocean than on the land. On land we need to create mines and dig into the earth to get the minerals. In the ocean it is easier because they don't need to remove all of that. It probably makes it safer as well."

"Perhaps, but the mining will still be disruptive to the animals living in the ocean. When they mine, small particles are released that are harmful to filter-feeding organisms in the area." Monica loved animals and didn't like to think about them being killed and pushed out of their habitat.

Learning Issues

Below is a list of learning issues collected from the Oceans Explorers case. As a group you are to research ALL of the following learning issues. Put the person's (or 2 people's) initials who is responsible for researching the learning issue on the line next to the learning issue. Every learning issue must have at least one person's initials and this learning issue must be copied over to your individual learning issues handout and researched. There are 2 sides to this sheet, make sure to flip the page over.

_____ _____ What is topography?

_____ _____ What does exploration mean?

_____ _____ What is the topography of the ocean floor? Is it flat?

_____ _____ What are the names of different features of the ocean floor?

_____ _____ What is the Mid Ocean Ridge?
_____ _____ Where is the Mid Ocean Ridge?
_____ _____ How is the Mid Ocean Ridge formed?
_____ _____ Where is the Pacific coast?
_____ _____ What is an ocean?
_____ _____ How many oceans are there?
_____ _____ Where are the oceans located? What are their names?
_____ _____ What is mining?
_____ _____ How does someone mine in the ocean?
_____ _____ What are minerals?
_____ _____ What minerals can be found in the ocean floor?
_____ _____ How does ocean mining affect ocean-life? What are the effects of mining in the ocean?
_____ _____ What is a species?
_____ _____ What are some animals found in the ocean?
_____ _____ What are squids?
_____ _____ What worms are found on the ocean floor?
_____ _____ What is a Fangtooth?
_____ _____ Is there light at the bottom of the ocean? Why is it dark at the bottom of the ocean?
_____ _____ How do people explore the ocean floor?
_____ _____ If there isn't light at the bottom of the ocean, how do underwater vehicles navigate (move around without hitting things)?
_____ _____ How deep is the ocean?
_____ _____ What is the temperature of the ocean?
_____ _____ How does the temperature change depending on the depth of the ocean?
_____ _____ What is the Canadian Press?
_____ _____ What do scientists do?

Resources

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