Oceanography topics are tremendous hooks to engage students in Life and Earth Science projects. This paper explores a number of lessons with extensions across the curriculum.

The beach and ocean are exciting places, especially for children. Thus, Oceanography topics are tremendous hooks to engage students in national standards based lessons in Life Science, Physical Science and Earth Science, and can provide an avenue to discuss Ecology and Ecosystems. Because of the interdisciplinary nature of oceanography, these topics also provide avenues to explore science as inquiry, science and technology, and science in personal and social perspectives.

These lessons easily adapt to meet needs of students with various backgrounds and abilities. Furthermore, the use of an ocean model to study a variety of science topics may help some students by eroding the negative stereotype of scientists working in dank laboratories muttering to themselves over bubbling potions.

Even students who do not have the opportunity to go to the beach or visit an aquarium are fascinated by ocean creatures. A number of activities are presented, connecting the fascination of the ocean with science content, in a way that becomes relevant to all students. Specific grade levels were not assigned to each question or extension, since materials are integrated with different modalities across the curriculum so students with a variety of learning styles and interests can benefit. For example, inclusion of manipulated objects is helpful to tactile and kinesthetic learners. Additionally, teachers can have students draw or model shorelines to learn about their different features. Visual learners will appreciate the pounding surf removing the beach. Less advanced students will gain observation and dexterity skills, while higher-order thinking questions and various extensions will keep gifted children stimulated. Thus, a wide range of learning abilities can be reached with the same basic hands-on manipulation. Older or more advanced students will be more involved in the development of the activity and delve deeper into the science content surrounding the activity.

These lessons were developed for an early childhood audience; however, they can be easily adapted for older students with the extensions provided.

These lessons can be used in early education classrooms or in informal learning centers. For very young students, conduct the lessons in small group learning situations or in centers. We conducted these lessons with students working in pairs. It is important for each pair of students to have a set of equipment so that students can be actively engaged. These lessons provide opportunities to explore with graphs, observations, and scientific processes. Thus, for the Pre-K students, these lessons were given near the end of the year.

**LESSON 1: CLASS SAND AN SHELL COLLECTION**

**OBJECTIVES**

Students observe, sort, and classify objects by size and other characteristics.

Students utilize scientific tools.

**MATERIALS**

- Sand
- Small objects mixed into sand
- Wire mesh sieves (with various size holes)
- Magnifying glasses and/or microscopes
- It would be helpful to have pictures of the beach available for students who have never been to the beach.
SIEVE CONSTRUCTION

A variety of commercially available sieves are available, including ones developed as beach toys. A simple sieve can also be constructed by placing wire mesh inside the lid of a canning jar with the lid insert removed. The lip of the lid will keep the mesh from falling through.

METHODS

Obtain sand sample from a natural source at the beach shoreline so it contains a mixture of objects and particle sizes. If you do not have access to such sand, combine play sand and material of other particle sizes so there is a mixture for students to sieve. Add several objects, including plant material, shells, and small plastic objects to this mixture. The task works best with a mixture of shells so that students can find shells of different types and sizes (a few mm to a few cm). Plastic plants and animals can be used in place of actual specimens. Have pairs of students explore sand and sift it to find objects. If possible, use more than one sieve size so that different sized objects are collected in different sieves. Have students sort various-sized particles and sort objects by size and type. Have students explore found objects with magnifying glasses.

HIGHER ORDER THINKING QUESTIONS

These questions are helpful for guiding the students and challenging your gifted students to go further than the basic hands-on manipulation.

1. What is sand (particle size)? Where did it come from?
2. Which sieve do you use first to sort objects by size? Why?
3. What kinds of plants/animals lived near or on this beach?
4. Which plants/animals lived in water? Which plants/animals lived on land?
5. How does plastic get on the beach? Does it belong there?
6. Which weighs more, a container of sand, shells, or water?

EXTENSIONS

1. Use sand to explore texture, include various types of sands and materials of various particle sizes and colors.
2. Have students separate found objects into living/non-living, natural/man-made, and plant/animal.
3. Have students separate shells by bivalve (dam-like) and gastropod (snail-like) types.
4. Have students draw or model shorelines and plants and animals that live on beaches.

MATH AND DATA MANIPULATIONS

1. Students count objects and make Bar Graphs of sub-groupings.
2. Students predict how many shells fill a small container.

LESSON II: BEACH EROSION

OBJECTIVES

Identify the effects of water and waves on beaches.

Predict how various materials that make up a beach affect the beach's ability to withstand erosion.

MATERIALS

- Sand
- Pebbles
- Small tub of water
- Rigid plastic card similar in width to tub

It would be helpful to have pictures of the beach available for students who have never been to the beach.

METHODS

For each pair, build up a beach at one end of a shallow tub by putting down a foundation of pebbles covered over by sand. In one corner of beach, build pebbles higher than the water. Have students predict the effect of waves on the beach. Have students make waves by moving the plastic card in the water. Have students observe effects of waves on the beach. You can also place small models on the beach to represent houses or trees. Be sure that these models are age appropriate and not a choking hazard for young children.

HIGHER ORDER THINKING QUESTIONS

These questions are helpful for guiding the students and for challenging your gifted students to go further than the basic hands-on manipulation.

1. Where did the sand go?
2. Why did the pebbles remain on the beach?
3. What could cause large waves?
4. What would happen to buildings that were built close to the beach?
5. What animals live in sand?
A girl from the Annunciation Day School produces waves to demonstrate the effects on beach erosion.

6. How do the waves affect plants and animals at the beach?

7. What kind of beach will survive large waves the longest?

8. How does the presence of bedrock (pebbles?) effect beach erosion?

9. What are some types of erosion control devices? What are benefits and problems of using erosion control devices?

10. What is long shore drift and how is this related to beach erosion?

EXTENSIONS

1. Allow students to build the beach from various materials (sand, pebbles, rocks, wood, soil, etc.). Provide materials or allow students to gather them from school grounds. Students could also try to build structures on the beach that will withstand the waves.

2. Students could predict and explore how wave size is affected by water depth and card size (or card material) used to generate waves.

3. Students race a fresh leaf around the water with a small battery-operated fan, and discuss how objects such as seed pods can be dispersed by ocean currents.

4. Students draw a beach picture or do a beach shadow box.

5. Students build an erosion control device and see how well their device works to prevent erosion.

LESSON III: TYPES OF WATER ON EARTH'S SURFACE

OBJECTIVES

Observe the effects of salt water content on flotation.

Make predictions about behaviors of common objects in water.

MATERIALS

- Glass of water
- Mini carrot
- Chopstick or stirrer
- Salt
- 5 ml (or teaspoon) measure
- Graduated cylinder or other measuring device for water

METHODS

Two students, working together, measure 250 ml (or 1 cup) of tap water into a cup. Ask students to predict how a carrot will behave in water. Students then place a fresh mini carrot into a glass of water. (This experiment will not work well if the carrot is dried out.) Students observe the carrot as they add 5ml (or one teaspoon) of salt to a glass and stir until it dissolves. Students continue to add measured salt to a glass until the carrot floats.

HIGHER ORDER THINKING QUESTIONS

These questions are helpful for guiding the students and for challenging your gifted students to go further than the basic hands-on manipulation.

1. Where is salt water located? Where is fresh water located?

2. What is brackish water? Where is brackish water located?

3. Why did the carrot float in salt water?

4. How is a lake different from an ocean?

5. Is it easier to swim (or sink or float) in the ocean or a river?

6. Is it easier to dissolve salt in hot or cold water?

7. What kind of water can we drink?

8. What kind of animals live in water all the time? What kind of animals live in water for part of their life? What kind of animals never live in water?

9. Why do some animals survive only in salt water and others only in fresh water?

10. What are the general characteristics of objects that float in fresh water? What are the general characteristics of objects that float in salt water? Do objects that float in fresh water float differently in salt water?
EXTENSIONS

1. Students pick items to try to float in fresh and salt water. Provide some objects that will float in either fresh or salt water (cork, leaf), some objects that will only float in salt water, and some objects that will not float in either (rocks, metal). Ask students to make predictions about which items will float in each solution.

2. Students explore by substituting other granular material (sugar or sand) for salt and predicting the effect of adding these materials to fresh water.

3. Students explore the concept of buoyancy and how buoyancy relates to different marine animals.

MATH AND DATA EXTENSIONS

1. Students calculate the total amount of salt needed to produce a floating carrot.

2. Students calculate percent of salinity (% of salt) of the solution that allows a carrot to float.

3. Students graph a number of items in each group—will not float, floats in salt water only, and floats in salt and fresh water. Have students make a Venn diagram of floatable objects.

4. Using a balance, students compare weights of objects that will float in fresh water, float in salt water, or not float in either. These objects will need to be of similar size to allow them to explore the concept of density.

LESSON IV: POLLUTION

OBJECTIVES

Understand what pollution is and where it occurs.

Understand that some pollutants cannot be seen.

MATERIALS

- Clear tub of water
- Food coloring
- Clear cups of water
- Clear substance with a distinctive odor (i.e., white vinegar)

METHODS

Talk with students about pollution and how it can be found in water, air, or ground. Have students define pollution and discuss examples of each. As a demonstration, have a student put in five drops of food coloring into a clear tub of water while another student stirs. Ask them why the color disappears. Discuss what happens to the color. Students continue to add a counted number of food coloring drops until it stops disappearing. Discuss why the color stops disappearing.

Prior to class, prepare two small cups of water (in a clear cup) by adding white vinegar to one and food coloring to the other. Use a mixture of colors so that the color will not be appetizing. Blindfold a student and ask them to smell each cup and ask which one he/she would want to drink and why. Remove the blindfold and ask which one he/she would want to drink. (This can also be done in pairs rather than as a class demonstration.) Although it would not be dangerous, be sure to tell the students not to drink from the cups.

HIGHER ORDER THINKING QUESTIONS

These questions are helpful for guiding the students and for challenging your gifted students to go further than the basic hands-on manipulation.

1. How does pollution affect rivers and oceans?
2. Can pollution affect mountains?
3. What form of transportation (i.e., cars, buses, bikes) makes the most/least pollution?
4. How can we prevent and/or lessen pollution?
5. Besides air pollution, how do cars pollute (small oil leaks go into water)?
6. How do fertilizers cause pollution?
7. What do you do with paint you do not need or want?
8. Why is it important to turn off the water when you are brushing your teeth?
9. Why is it important to turn off the lights when you leave a room?

10. What kinds of animals and plants are affected by pollution?

EXTENSIONS

1. Students add different colors to water and predict what new colors will be formed.

2. Students try to devise a way to filter out the pollutants (vinegar, food coloring) that were added to the water. (They may not be successful.) Have them add other substances as well, such as soil or sand, and determine which types of pollution are hardest to remove.

3. Talk about how garbage is related to pollution, including the process of disposing of garbage.

4. Discuss recycling, and have students recycle newspaper into paper. Have students help to recycle materials in the classroom.

5. Have students make an art project out of objects that would otherwise be trash.

MATH AND DATA MANIPULATIONS

1. Students explore how many drops of coloring it takes to change the color of various amounts of water.

2. Students graph drops of water and volume of water for the experiment.

WEBSITE RESOURCES:

Virginia Institute of Marine Science:
http://www.vims.edu/adv/ed/

Online Wave Simulator:

Erosion Lesson Plan:
http://www.col-ed.org/cur/sci/sci03.txt

Pollution Lesson Plan:

National Standards:

Additional Oceanography Education and Teacher Resources:

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PHOTO CREDIT

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