Web Unit Plan

Title: Healthy Oceans, Healthy Planet

Description: Working in cooperative groups, students become marine biologists and oceanographers, offering testimony to the United Nations about the health of various ocean ecosystems. Students inform UN delegates about the fate of our oceans, and then offer ideas for protecting our watery world by creating informational brochures and presenting their findings.

At a Glance

Grade Level: 3–5

Subject sort (for Web site index): Science

Subject(s): Science

Topics: Oceanography, Geography, Ecology

Higher-Order Thinking Skills: Decision Making, Analysis, Problem-Solving

Key Learnings: Ecosystems, Population Pressures, Cause and Effect

Time Needed: 4 weeks, 60 to 90 minutes per lesson, daily

Background: From the Classroom in Texas, United States

Unit Summary

Young marine biologists and oceanographers study our world's oceans and serve as expert witnesses at a hearing before delegates at the United Nations. Students describe the state of our world's oceans, explain the significance of healthy oceans for a healthy planet, and make suggestions for solving environmental problems in the watery part of our world. During the course of this unit, students assume the roles of marine biologists and oceanographers as they create a brochure about protecting the ocean's delicate ecosystem. They deliver the brochure to the UN delegates.

Curriculum-Framing Questions

- **Essential Question**
  How are we interconnected?
- **Unit Questions**
  Why are our oceans important?
  What problems do our oceans face?
- **Content Questions**
  How does human activity change the shore?
  What are the three main groups of life that live in the ocean?
  What are some of the resources of the ocean and their uses?
  What factors contribute to the pollution of our oceans?

Assessment Processes

View how a variety of student-centered assessments are used in the Healthy Oceans, Healthy Planet Unit Plan. These assessments help students and teachers set goals; monitor student progress; provide feedback; assess thinking, processes, performances, and products; and reflect on learning throughout the learning cycle.

Instructional Procedures

Prior to Instruction

In advance of Week One, prepare an example graphic organizer that shows the interrelationships among living and nonliving factors in one ocean ecosystem.

In advance of Week Two, prepare the lab demonstrations described.

Week One: Discovering the Ocean's Problems

Introduce students to their mission as expert witnesses on an ocean ecosystem. Pose the Essential and Unit Questions:

- *How are we interconnected?*
- *Why are our oceans important?*
- *What problems do our oceans face?*

Explain that students will become ocean scientists who understand marine ecosystems and can help others make decisions about protecting the ecosystems. Tell them that they will be placed into small heterogeneously formed groups. Each group's main task will be to analyze the problems of one ocean ecosystem, and consider solutions based on previous interventions and their own novel ideas. Explain that each group will use the following study outline, and each student within each group will pick two topics to guide the research:

- An overview of the ecosystem (where it is, what makes it unique from others, a description of the web of life in that ecosystem, and relating living and nonliving factors)
- Background on a problem (when the problem was first identified, how it is measured, related problems, and how serious it is)
- Possible reasons for the problem (factors, human and otherwise, supported by data)
- Previous efforts to lessen the problem and those outcomes (who did this and how does it work)
- Newest research into the problem
- Suggestions for helping with the problem

Guide students in a discussion of the United Nations (UN and its purpose as a worldwide decision-making body). Visit this UN Web site for children* to learn more.

Ask students to consider the ways we rely on the oceans, both directly (such as fishing, recreation, and shipping) and indirectly (such as the weather systems' role in ocean currents). Instruct students to create a T-chart graphic organizer that lists the direct and indirect ways we rely on oceans.

Show the oceans and seas on a large world map, and teach the names of the large bodies of water. As a class, discuss which oceans are relied on more heavily and what ways humans affect the oceans. Show how water flows from land to ocean and from ocean to ocean. (Landlocked sea ecosystems could be assigned as a separate extension activity, since the issues are somewhat different in those ecosystems.)

Optional Activity: Use the *Visual Ranking Tool* to list the ways humans affect the ocean and rank the list in order of positive to negative ways.

Discuss why ocean problems are everyone's problems—we are interdependent, and our oceans and seas are interconnected. Discuss the concept of shared decision making; we share the oceans, so protecting them has to be a cooperative effort among nations.

Present the concept of ecosystems, and lead a discussion to draw out students' prior knowledge. Write science vocabulary as it is expressed, and elaborate on terms that may be unfamiliar to some. Narrow the focus to water ecosystems, and ask students what they know about freshwater, estuary, and ocean ecosystems. Show The Ocean Planet slideshow, and have students take notes on saltwater ecosystems using a science study guide. Explain that the study guide will be a work in progress, and it will be used to capture the information needed for later projects.

Optional Activity: Use the *Seeing Reason Tool* to demonstrate cause-and-effect relationships related to problems affecting the oceans. Pose the Content Question, *What factors contribute to the pollution of our oceans?* Have the students share their *Seeing Reason* maps with the class.

Assign marine ecosystems in need of protection (for example, Maine's seacoast; the Great Coral Reef of Australia; the ecosystem of the Florida Keys, Coastal Alaska, or Louisiana; and so forth) to small groups. Over the course of three weeks, students research their topic in the school library, online, and at home to learn what problems exist in their ecosystem, and develop thoughtful suggestions for alleviating at least one problem. Show students how to make a brochure to support their testimony. Distribute the brochure assessment beforehand to discuss project requirements and to guide both content and quality of student work. Review the checklist and rubric, and answer any questions.

Teach about the interdependence of plants and animals in the ocean, and the delicate balance within the ecosystem. Model how students can use a graphic organizer or the *Seeing Reason Tool* to show relationships among living and nonliving factors in the ocean, anchored around one central plant or animal. As preliminary research on oceans continues, have small groups study, then draw and write about one interdependent system in an ocean ecosystem. Use this research time to check in with groups to monitor progress, answer questions, and address any concerns.

Week Two: Researching and Understanding Our Oceans

During this week, provide research time in addition to teaching the series of science lab lessons. Within their small groups, students should identify at least one problem in their ecosystem at this point, and make an "interaction web" using the *Seeing Reasoning Tool* to show how living and nonliving factors in the ecosystem are related.

During the following demonstrations about the moving oceans (currents, tides, and waves), encourage students to take notes and answer questions in their science study guide. Understanding these concepts will help students make sense of the dynamic processes going on in the ocean ecosystems they are studying.

Demonstrate the relationships among temperatures, deep ocean circulation, and currents, using Hydrologic Cycle*. Have students make a lab sheet that has spaces to write new terms and outcomes, and after they watch the demonstration, have

them draw a storyboard with captions showing each step and how it relates to ocean current and weather. Another experiment, Ocean Currents and Coastal Temperature*, can be done to explain why coastal regions tend to be cooler or warmer depending upon the ocean current.

Study the characteristics of waves and the three major factors that influence the creation of waves using this NASA Wave Demonstration* (PDF; 2 pages) activity. Discuss the effect of wave action on erosion, stirring nutrients, and oxygenating water. Have students take notes as they watch the demonstration, then answer the question, *Why does the ocean have waves*? in their own words.

To study tides, display this School Observatory Astronomy* site. Students can find the tide tables of the ocean or sea they are studying at Tide and Current Predictor*.

Week Three: Continuing and Learning From Our Research
Continue to provide research time during this week. Students should determine the factors that relate to the specific ecosystem problem they have identified.

Show the videos *Oceanography* and *Ocean Life*, from the Bill Nye Series (program numbers listed in this unit's Resources section).

Identify ocean floor features and describe each. *National Geographic* magazines are a good resource for ocean floor landform maps. Have students study such maps, finding various features, such as continental shelves, underwater mountain ranges, and rifts. Discuss how scale is interpreted on these maps. Challenge students to find out how scientists map the ocean floor, starting with how they measure depths. Have students draw a cutaway view of the ocean floor in their ecosystem, labeling features and elevations.

Give a brief history of ocean exploration and discuss new technologies in ocean research. Have students complete the vocabulary and questions sections of their study guide sheets relating to the ocean floor and ocean technologies.

Week Four: Learning About Pollution and Developing a Proposal
Continue providing research time this week. Students should study the kinds of interventions that have been employed to solve their identified problem.

Study ocean resources this week, including food, raw materials, oil, and mineral resources. The study guide sheets should be completed.

To show students how an ocean ecosystem is affected by pollution, set up a demonstration. Create guiding questions and have a recorder write responses from the class as you present the demonstration.

Use the remainder of the week to develop projects. Help student groups take the information they have gathered in the last three weeks and isolate a clear problem and a fully developed proposal for a solution. Have them summarize their report in a brochure, which they can give to the UN delegates to support their oral presentations. Show students the example brochure and answer any questions. Review the brochure assessment, answer any questions, and check for understanding. Provide time for students to practice their presentations, and have students from different groups listen and ask questions, helping groups to clarify

their messages. Invite a same-grade class to serve as UN delegates. This is a teaching opportunity for your students, so they should provide the following whole cycle of instruction:

- An overview of the ecosystem (where it is, what makes it unique from others, a description of the web of life in that ecosystem, and relating living and nonliving factors)
- Background on the problem (when the problem was first identified, how it is measured, and how serious it is)
- Possible reasons for the problem (factors, human and otherwise, supported by data)
- Previous efforts to lessen the problem and those outcomes (who did this and how it worked)
- Newest research into the problem
- Suggestions for alleviating the problem

Set aside time for the presentations, and, as each group finishes, have student "delegates" ask questions of each team of "witnesses." Hand out presentation feedback forms to a group of chosen delegates. They will use these forms to offer feedback and record their questions and the witnesses' answers. Passing out a list of generic questions to both the "delegates" and "witnesses" may help students to be prepared.

Grade the oral presentation as a performance task. The students' ability to field questions will also give you insight into their overall understanding. Grade the small groups' brochures using the assessment rubric. Give a final test over the ocean ecosystems, and grade science study guides.

Conclude the unit by having the class develop a bulletin board that can be displayed in a school common area. Using the title "We Are Interconnected," have the students brainstorm ways they can share what they have learned about the unit's Curriculum-Framing Questions:

- *How are we interconnected?*
- *Why are our oceans important?*
- *What problems do our oceans face?*

Prerequisite Skills

- Basic computing skills, including keyboarding and Internet research
- Knowledge of the water cycle
- Desktop publishing skills
- Internet knowledge to access information for brochures
- Library research skills

Differentiated Instruction

Resource Student

- Modify the amount of work required
- Break assignments into small, manageable segments and write them on a checklist
- Provide more support, using teaching assistants, parent aides, and student helpers

- Provide extra time to complete activities (possibly during resource classes)
- Create student pairs that can support one another

Gifted Student

- Have the student serve as an expert during research
- Encourage the student to investigate more complex questions
- Encourage the student to include more advanced technical attributes in the brochure
- Have the student add additional enhancements to the slideshow presentation

English Language Learner

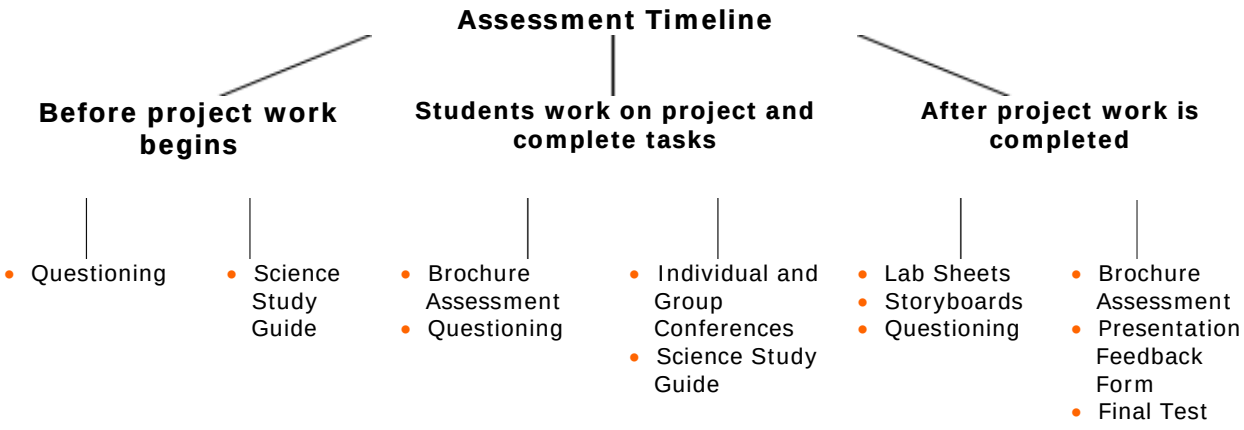
- Create student pairs, when possible, that consist of an ELL student and a more proficient bilingual student
- Provide explanations in the first language when possible
- Use visual aids
- Modify work requirements
- Allow for work to be done in the student's first language and then get a translation

Credits

Diane Gifford participated in the Intel® Teach Program, which resulted in this idea for a classroom project. A team of teachers expanded the plan into the example you see here.

THINGS YOU NEED (highlight box)

Assessment Plan



Questioning is used throughout the unit to assess prior knowledge and help students develop their higher-order thinking skills and process content. Students use the science study guide and brochure assessment to help guide their learning, stay on track, and self-assess their progress. The quality of comments in their optional *Visual Ranking Tool* list and/or *Seeing Reason Tool* map, as well as notes in their science scoring guide help both teacher and students to monitor progress and understanding of content. Individual and team group conferences are conducted during research to help monitor progress and answer any questions. The lab sheets and storyboards completed during experiments and demonstrations help students to self-assess learning and can be used to monitor and adjust teaching. Ask students to use the brochure assessment to guide both the content and quality of their work as they work on the project. This same rubric is used to assess and grade the final project. The presentation feedback forms allow students an opportunity to provide feedback

to their peers during oral presentations. Individual progress is assessed with the final test.

Targeted Content Standards and Benchmarks

Texas Essential Knowledge and Skills (TEKS):

Science TEKS

- Identifies sources of water on Earth
- Contrasts the properties of freshwater and saltwater
- Identifies ocean floor features
- Researches various ocean resources
- Illustrates and labels the parts of a wave
- Explains how the gravitational pull of the moon causes tides
- Differentiates between tides and currents
- Locates ocean currents and describes their effect on climate

Technology TEKS

- Demonstrates skills related to multimedia terminology
- Uses resources available on-site to present completed multimedia presentation
- Understands the role of the Internet and its uses

Student Objectives

Students will be able to:

- Understand ocean vocabulary
- Understand the processes that create waves, currents, the ocean floor's topography, and tides
- Demonstrate understanding of the complexities and interrelationships of the ocean ecosystems
- Identify, compare, and contrast natural versus human activities that affect ocean and shoreline
- Recognize the ocean as a finite resource that needs protection
- Describe and defend the protection of a specific marine ecosystem using publishing and multimedia software

Technology and Resources

Printed Materials

- *National Geographic.* (1915–).[Magazine]. Hanover, PA: National Geographic Society.

Supplies

- Items needed for experiments (see each experiment)

Internet Resources

- SeaWeb
  www.seaweb.org*
  Classroom SeaWeb project designed to raise awareness of the world ocean and the life within it
- Smithsonian in Your Classroom

http://smithsonianeducation.org/educators/lesson_plans/ocean/main.html*
Interdisciplinary marine science activities within a lesson plan with information and pictures about the ocean, includes a curriculum kit with ideas to use in the classroom

- Tide and Current Predictor
  http://tbone.biol.sc.edu/tide/sites_allalpha.html*
  Tide data about sites around the world and a tide predictor to input data and predict tides while creating a plot line graph using different options
- The United Nations: An Introduction for Students
  www.un.org/Pubs/CyberSchoolBus/unintro/unintro.asp*
  Facts about the United Nations and the UN's purpose

Video

- Ecosystems: Nature in Balance, #VC15160 (Week 1)
- "Ocean Life," *Bill Nye Series*, #VC16548 (Week 3)
- "Oceanography," *Bill Nye Series*, #VC16541 (Week 3)
- "Oceans, the Cradle of Life," *Our Wondrous Oceans Series*, #VC60139 (Week 4)
- "Oceans: Charting the Vastness," *Survey of Science Series*, #VC17357 (Week 4)

Technology—Hardware

- Computers to create brochure and conduct ocean research
- Internet connection for ocean research, conducting online experiments and accessing Interactive Tools (*Seeing Reason Tool* and *Visual Ranking Tool*)
- Television and VCR to view videos

Technology—Software

- Desktop publishing to publish brochures
- Encyclopedia on CD-ROM for ocean research
- Internet Web browser to conduct research on sites and conduct experiments online
- Word processing to input information into brochures