

Section 2.1 INTRODUCTION

2.1 Understand the Question

Water-Quality Indicators

(1 class period)

Overview

Students are introduced to the driving question of *Learning Set 2: How do you determine the quality of water in a community?* When challenged to determine what would happen if their watershed were their only source of water, students begin to think about the quality of that water. They consider ways to determine the quality of water. Students return to the *Project Board* to record what they think they know about water quality. They also record questions about water quality that they think they might want to investigate. This activity prepares them for activities they will do in subsequent sections where they are introduced to and investigate several measures of water quality.

Targeted Concepts, Skills, and Nature of Science	Performance Expectations
Some common water quality indicators that can be measured are pH, temperature, turbidity, levels of dissolved oxygen, nitrates, phosphates, and fecal coliform bacteria.	Students should be able to indicate that pH, temperature, turbidity, levels of dissolved oxygen, nitrates, phosphates, and fecal coliform bacteria are indicators of water quality that can be measured.
How land is used can affect the water quality in a watershed.	Students should be able to relate land use to water quality in a watershed.
Scientists plan investigative questions and communicate ideas.	Students should be able to voice that scientists can plan investigation and communicate ideas to one another.

*A class period is considered to be one 40 to 50 minute class.

Materials

1 per class class *Project Board*

Homework Options

Homework options provide students with some short, relevant work options. Each of these assignments encourages reflection on the current section or prepares students to make the connections between one section and the next. A variety of homework option tasks are included throughout the Unit.

Reflection

- **Science Content:** What can happen in a community where microbes are found in the water? How might these microbes affect the community? How are they spread? *(Students may connect their responses to information learned in the communicable disease Unit.)*
- **Science Content:** In *Learning Set 1*, you determined that there was a relationship between land use and the condition of watershed moving through a watershed. Think about this relationship. Write two sentences describing how industrial land use and residential land use might affect water quality. Give a reason for each statement. *(Answers will vary. Students may say that industrial land use damages water quality because it often pollutes water with chemicals. Residential use also can affect water quality by careless dumping of materials like motor oil into drains.)*

Preparation for 2.2

- **Science Process:** On page 54 of the student text, four students discuss different ways to check the quality of a community's water supply. Each has a different opinion. How do you think their meeting is like one that scientists might hold when faced with a problem? *(Answers will vary but probably will include that four scientists may have each have a different opinion on a problem. They listen to each other's thoughts and out of this may come new ideas or a way to investigate the problem.)*

SECTION 2.1 IMPLEMENTATION (page 54 goes with this section)

2.1 Understand the Question Water-Quality Indicators

(1 class period)

Students are given the opportunity to share their experiences. This motivates them for what they are about to learn.

Engage

Begin by asking students if they have ever heard a warning not to drink the water that comes into their homes without first boiling it for a few minutes. Make a list of students' responses about their experiences with drinking-water warnings. *(Some may relate alerts that they have heard on television news broadcasts, on the radio, or in newspapers. Some may have seen warning signs at a beach similar to the one on page 54 in the student text about unsafe swimming conditions.)*

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The students understanding of a science concept has more meaning if it can be related to something they have experienced.

[end meta note]

Get Started (page 54 – Get Started)

20 min.

Students want to know why they are doing things. The scenario at the beginning of the Learning Set provides the learner with a reason being concerned about community water quality.

Guide Discussions

Introduce the topic of testing water quality by planning a class discussion. Inform the class that they should read page 54 and think about the questions at the end of the page. Select four students at random to play the rolls of the four students shown on page 54 in the student text. Have them sit across the front of the room, much like a panel. Have a fifth student introduce the purpose of the panel discussion (To find out how a community might decide if its water supply is safe). Each of the four can read the script in the text, in turn, about how he or she thinks water quality can be tested. Then open the discussion to questions and opinions from the class. If the class is reticent about asking questions, be prepared to ask “Do you agree or disagree with the method (student name) has suggested?” to start the discussion.

- Remind students to give a reason for their opinion in a class discussion.
- As methods for detecting and testing water quality are suggested, make sure they are recorded for later use on the *Project Board*.

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Initially you may have to use wait-time for the class to begin asking questions of other students. In your mind, count to ten before resorting to calling on a student. Students eventually will become involved in the discussion.

[end meta note]

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If, during a class discussion, students are beginning to ask too many yes/no questions or questions that utilize one word answers, begin to model asking questions that require more extended answers such as “How did...,” “Why do you think that...?” “What did you mean when you said that...?”

[end meta note]

Update the Project Board (page 55 goes with this section)

(10 min.)

Students work to update the *What do we need to investigate?* column of the *Project*

Board. Students also can add new information to the first column, *What do we think we know?*

The discussion seems to have raised a lot of new thoughts and questions. It's probably time to update the *Project Board*. Let's see where we left off. Where might we record what we've been saying about testing water quality? What makes water of good quality? What makes water harmful? What have you decided that you want to learn more about? Which of these questions might be turned into investigations?

Get Going

Record students' ideas in the appropriate columns of the *Project Board*. There is no need to determine now if these ideas are right or wrong, doable or not doable. Write items that students disagree about, or can't seem to make a decision about, in the second column. Explain that scientists often have similar problems.

Guide

Write a date on all entries. This reminds students that the *Project Board* is a dynamic organizer and is used for a growing list of information and insights into a problem.

Evaluate

Make sure that all students have an opportunity to voice an opinion about items entered on the *Project Board*.

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The *Project Board* can be revisited many times as ideas become modified. Trained scientists keep notebooks and other records of the progress of their thinking. Periodically they revisit these notes to see how their ideas are fitting together. This is like periodically checking the *Project Board* to see if it has information that can be used to answer the driving question.

[end meta note]

Assessment Options

Targeted Concepts, Skills, and Nature of Science	How do I know if students got it?
<p>Scientists often work together and then share their findings. Sharing findings makes new information available and helps scientists refine their ideas and build on others' ideas. When another person or group's idea is used, credit needs to be given.</p>	<p>ASK: How did the students in the text reflect the way scientists sometimes work together? LISTEN: Answers will vary, but you should be able to hear students saying that the each student scientist was allowed to express his or her ideas of how to test for water quality. Classroom discussion is somewhat like letting the whole scientific community think about the ideas. During the classroom discussion, other students might have added new ideas or information to the ideas expressed.</p>
<p>How land is used can affect the water quality in a watershed.</p>	<p>ASK: What did you learn about land use in Learning Set 1 that you can use to find out how safe water might be in your community? LISTEN: Answers will vary but students may say that the way land is used in the community can contribute different materials added to water and therefore affect the quality of the water available in a community.</p>
<p>Scientists plan investigative questions and communicate ideas.</p>	<p>ASK: In what ways do you act and think like a scientist when you work in a group? LISTEN: You should hear students indicate that sharing ideas is one way that groups act and think like scientists.</p>

Teacher Reflection Questions

- In this section, students determined that they will investigate water quality. What difficulties did students experience in thinking of ways to test for water quality?
- How can students be guided to make more of a connection between the information they put on the *Project Board* from *Learning Set 1* and the driving question?
- The goal of this introductory activity is to activate students' initial ideas and prepare them for further investigation. Did they all feel free to suggest what they thought would work as a test for water quality? If not, how can you get more of them to express their opinions without feeling they will be judged.