

Master Teacher Name: Tamar Burris
Lesson: Keep It Clean!
Grade Level: 5
Time Allotment: 1½ hours



Overview: In this lesson students will watch a video on water pollution that will explain what water pollution is and how it occurs. They will then participate in an interactive Internet activity in which they will be asked to spot causes of water pollution and water waste. They will also conduct an experiment to see what happens when you mix oil or soap with water and use corks and sponges to understand that oil spills and other forms of water pollution impact marine animals. At the end of the lesson students will participate in a hands-on activity that will help them understand that water pollution hurts animals, humans, and the environment.

Subject Matter: Science

Learning Objectives:

Students will be able to:

- Identify several causes of water pollution;
- Identify several ways we can help stop water pollution; and
- Demonstrate an understanding that water pollution affects both humans and animals by participating in a hands-on activity and discussion on pollution.

Standards:

The following standards were taken from the State of Montana Office of Public Instruction Web site at <http://www.opi.state.mt.us/>

State of Montana Science Content Standard 1: Students design, conduct, evaluate, and communicate scientific investigations

Benchmark – *Represent, communicate, and provide supporting evidence of scientific investigations*

Science Content Standard 3: Students demonstrate knowledge of characteristics, structures, and function of living things, the process and diversity of life, and how living things interact with one another and their environment.

Benchmark – *Explain cause and effect relationships in living systems and nonliving components within ecosystems; investigate and explain the interdependent nature of biological systems in the environment and how they are affected by human interaction.*

Science Content Standard 5: Students understand how scientific knowledge and technological developments impact society.

Benchmark – *investigate local problems and/or issues and propose solutions or products that address a need, which considers variables (eg., environmental risks).; apply scientific knowledge and process skills to understand issues and everyday events.*

Media Components:

Video

Assignment Discovery: Water: Friend and Foe

Web Site

Environmental Protection Agency's Office of Water For Kids Page

<http://www.epa.gov/OWOW/NPS/kids/whatwrng.htm> -- In this interactive activity, students look at a picture in which people are doing several different things that cause water pollution or water waste. By clicking on the spots where they think somebody is doing something that might be harmful to our water supply students will then get to read about this harmful activity and learn what can be done to prevent this type of waste or pollution.

Materials:

Per Student:

- "A Waterless World" handout, 1 per student
- Pencils and erasers

Per Group of Students:

- Glass or plastic jars with tight fitting lids, 2 per student group
- Water
- Blue food coloring (several drops per student group)
- Vegetable oil (about ½ cup per student group)
- Piece of cork, 1 per student group (a cork from a bottle works well)
- Red food coloring (several drops per student group plus enough to color pasta)
- Liquid soap (about 2 oz. per student group)
- Piece of sponge, 1 per student group (about a ¼ of a medium-sized sponge per student group is fine)

Per Class:

- Drop clothes or newspaper for covering desks
- 1 cup dry pasta (spiral noodles work best)

Prep for Teachers:

- Load video and cue to visual cue of bridge over river with large boat with audio cue of "As cities and industries around the world..."
- Bookmark <http://www.epa.gov/OWOW/NPS/kids/whatwrng.htm>
- Coat the pasta with red food coloring and let dry prior to lesson
- Photocopy "A Waterless World" handout

When using media, provide students with a Focus for Media Interaction, a specific task to complete and/or information to identify during or after viewing of video segments, Web sites, or other multimedia elements.

Introductory Activity:

1. Ask students to raise their hands if they know someone who has ever littered. "Why is littering bad?" (*Answers will vary*) Guide students to an understanding that garbage that is not properly disposed of will wind up creating pollution. It sometimes goes into waterways like rivers or streams and makes the water dirty and unhealthy for the plants and animals that live there.
2. Ask students if they have ever visited a lake, river, stream, or ocean that was polluted. "What was it like?" (*Answers will vary, perhaps it smelled bad, there was litter on the ground or in the water, maybe there were dead fish or animals in the water or the fish did not look healthy*)
3. Ask students if they think it is important to have clean water. "What is water used for?" (*Cleaning, drinking, watering plants, etc.*) "What would happen if there was no clean water in the world?" (*Answers will vary*)
4. Pass out the "A Waterless World" handouts and tell students to try to imagine a world with very little water and no clean water at all. What would it look like? Who would live there? Give students 15-20 minutes to work on the handout.
5. When students have finished writing ask for volunteers to share parts of what they wrote.

Learning Activities:

1. Tell students that they are going to be watching a video clip on water pollution. Set a Focus for Media Interaction: When we are done watching the first segment of this video I want you to be able to answer two questions for me: What is water pollution? What substances cause water pollution? PLAY tape from visual cue of a bridge over a river with a large boat and a voice saying "As cities and industries around the world..." PAUSE tape at "It's easier for humans to prevent pollution" with visual of a large pool next to a factory. Ask students to answer your focus questions. "What is water pollution?" (*Water pollution is the condition that occurs when any substance is introduced that has a negative effect on the water or the living things that depend on it*) "What substances cause water pollution?" (*Human and industrial waste, agricultural pollutants/runoff from fertilizer, oil and gasoline, toxic materials produced by heavy industry*) "Do you know of any companies or people who have contributed to water pollution?" (*Answers will vary*)
2. Tell students that there are some ways we can help prevent water pollution. In this next portion of the video they will hear about some of the things being done to prevent this type of pollution. Set a Focus for Media Interaction: When we finish with this part of the video I want you to tell me two ways people are working to prevent water pollution. START TAPE from the paused point, with a voice saying "Many companies are working to prevent..." and a visual cue of a river and factory. STOP the tape with a visual cue of water running down mist covered rocks and a voice saying "...a cleaner and safer future." Ask students to answer your focus question. "What are two ways people are working to prevent water pollution?" (*Industries are replacing toxic materials with less harmful*)

ones, farmers are irrigating fields with water used to clean farm equipment or planting fields of coarse grasses that filter agricultural chemicals from water before it reaches running streams or rivers)

3. Divide students into groups of 3-5. Tell the class that they will be conducting an experiment on water pollution. Have students cover the area where they are working with a drop cloth or newspaper. Give each group two jars with lids and enough water to fill the jars about halfway. Have students put several drops of blue food coloring in one jar and several drops of red food coloring in another.

4. Tell students to pour the vegetable oil in the jar with the blue water. Have them then seal the lid tightly and shake the sealed jar. "What happens to the oil and water?" (*The oil and water begin to separate*) "Where is the oil going?" (*To the top of the water*) Pass out the cork pieces and give each student a chance to feel the cork. "What does it feel like?" (*It is light; feels like wood, etc.*) Have the groups unscrew the lid on the oil/water combination and put the cork in the jar. Ask them to seal it tightly again and then shake the jar and set it aside.

5. Have students put a few ounces of liquid soap in the jar with the red water. Ask them to seal the lid tightly and shake the sealed jar. "What happened inside the jar after you shook it?" (*The water gets bubbly and soapy*) Pass out the sponge pieces and have the students unscrew the lid on the soap/water combination and put the sponge in the jar. Ask them to seal it tightly again, shake the jar, and set it aside.

6. Tell students to leave their jars to settle and have them move to computers, still remaining in their groups. Before having students log on to the bookmarked Web site Set a Focus for Media Interaction: Working in your groups, find four activities in this picture that may create water pollution Give students 15 minutes or so to look at the following Web site <http://www.epa.gov/OWOW/NPS/kids/whatwrng.htm> and click on the activities in the picture.

7. When students have finished working ask them to tell you four things wrong in the picture that might cause water pollution. (*Man throwing garbage on street, car leaking oil into storm drain, man pouring oil into storm drain, woman using harmful pesticides and fertilizers on her garden, sprinklers to near curb, and an arguable fifth, man raking leaves to throw them away instead of using them as mulch, stream bank erosion*) Talk about the man raking leaves into a garbage bag and discuss why this might create more water pollution. (*If he used the leaves as mulch they could help filter toxic chemicals before the water is absorbed into the ground. Also, if he rakes the leaves and throws them out in bags they become garbage and might be dumped in the ocean along with other refuse.*)

8. Have students return to their group workspaces and observe their jars. "Has anything changed in the oil/water jar?" (*Answers will vary*) "What is the cork doing?" (*Floating in the oil*). Have students take the lid off the oil/water jar and carefully take the cork out. Ask them to feel the cork. "What does it feel like?" (*It should be coated with the*

vegetable oil and feel oily) Explain to students that this cork is like a seagull, pelican, or duck. This is what happens to the feathers on these animals when their watery home is polluted with an oil spill or other toxic substance. It coats their feathers. Ask students if they think animals can fly with coated feathers. "How would oil in the water make life harder for these animals?" (*Answers will vary*)

9. Tell students to turn their attention to the soap/water jar. "What does it look like?" (*Red water*) "Do you think the soap has disappeared?" (*Answers will vary*). Have students shake this jar and look at it again. "Is the soap still there?" (*Yes, it is bubbly and sudsy again*). Have students carefully open this jar and remove the sponge. Ask students to pass the sponge around and squeeze it gently. "What comes out of the sponge when you squeeze it?" (*Water and soap*) Tell students that this is kind of like what happens to plants and animals that live in polluted water. They absorb the pollutants like a sponge.

10. Have students reseal the jars and allow them to observe them throughout the day.

Culminating Activity:

1. Take students outside to an enclosed area or a quiet part of the playground and divide them up into groups. Tell one group they are plants, another group they are small fish, the third group that they are medium fish, the fourth group that they are large fish, and the fifth group that they are human farmers. If there is an uneven amount of students, put more students in the small fish group.

2. Hold up a piece of colored pasta and tell students that this pasta represents pesticides and harmful fertilizers used in farming and agriculture. Give each member of the "farmer" group several pieces of pasta and ask them to scatter them about the area of playground in front of where the class is standing. When they have finished scattering the pasta have them rejoin the class. Tell the class that the area where the farmers scattered the pasta represents a lake or river.

3. Tell the group of plants that they are actually water plants and they grow and thrive in the water. Ask them to go pick up a piece of pasta and remain standing in the "water" where they found it.

4. Tell the small fish group to go "eat" the plant group by linking arms with one plant and then remaining in the spot where they had their meal. If there are more small fish than plants, scatter about some extra pasta and have them pick these up instead.

5. Have the medium fish group go "eat" the small fish by linking arms with one small fish and then remaining in the spot where they had their meal. Repeat the process with the large fish group, asking them to "eat" a medium fish.

6. Finally, have the human farmers "go fishing" for their dinner and ask them to attach to one of the medium fish and gently pull the whole chain out of the water and back to the area where you are standing.

7. Have students drop their linked arms and come sit altogether in a large circle. Ask the students who have a piece of pasta to raise their hands. Tell the class that these plants and small fish all absorbed or ate the harmful pesticides and chemicals that the farmers put in the water. Tell students to keep their hands up. Have all the students who "ate" the small fish or plants raise their hands. Tell the class that this group too has now ingested harmful pollution because they ate the plants and fish that were originally affected by the chemicals and pesticides.

8. Have all the students with their hands up continue to keep them raised and have the next group of students raise their hands if they ate the small or medium fish. Ask the class whether the harmful chemicals and pesticides have also now affected this group of students. *(Yes)*. "Why?" *(They ate fish that ate smaller fish or plants that had ingested or absorbed the chemicals)*. Have all students with their hands raised continue to keep them raised.

9. Have the group of farmers who fished for their dinner raise their hands and repeat your questions. *(Yes, they have also now eaten harmful pollutants because they ate the fish that were affected by the pollutants.)* Ask your students to look around at the class circle. "Is everybody's hand raised?" *(Yes)* "Why?" *(Because everyone was affected by the water pollution)*

10. Talk about ways in which this situation might have been avoided. *(The farmers could have used non-toxic fertilizers or could have planted fields of coarse grass to help filter out toxic substances before the water runs into a lake, river, or stream)*

Cross-curricular extensions:

Science/Math

Conduct science experiments to monitor the level of pollution in local waterways. Record graphs charting the levels of pollution from week to week or month to month.

Social Studies/Science

Research oil spills and other water pollution disasters and how they impacted the wildlife and local communities in the contaminated area.

Social Studies/Science

Research the history of government industrial waste regulations. Why did the regulations come into effect? Choose pollution hotspots and research the changes in the environment in these areas from the time that industry began there until present day.

English/Science

Have students write persuasive essays convincing school janitorial staff and groundskeepers to begin using non-toxic cleaning agents and agricultural products at school.

Community Connections:

- Organize a school clean-up day or a community clean-up day at a local beach, river, stream, or lake.
- Invite a local EPA official to the classroom to speak about water pollution.
- Plan a visit to an organic farm or invite an organic farmer to the classroom to speak about pesticides and fertilizers.
- Write letters to government officials asking them to keep our water clean.
- Create a mural to be displayed at the school or in the community that reminds people of the importance of keeping our waterways clean.

Student Materials:

