



6th Grade: Sum of the Parts

Suggested Time of Year

This lesson plan is about the cumulative effects of pollution and best management practices for protecting the Earth's resources. It fits well with the "leadership" theme in 6th grade.

Basic Concept

Students do not always realize how much the human population affects the environment. This lesson demonstrates, in a dramatic fashion, what happens when people along a river each pollute in their own unique way. The effects on the environment become greater with each person. Students "inherit" pieces of waterfront property and are allowed to develop them as they please. They soon realize the entire waterfront has been developed without proper planning and recognize that everyone's "pollution contribution" can be reduced. They identify how to remedy the pollution problem.

Contents

- Scripted Lesson Plan
- Preparation Checklist

Lesson Plan

Organizational Considerations

Classroom Time: 50 minutes

- 5 minutes, warm-up
- 5-7 minutes, instruction
- 7-10 minutes, student group activity
- 15-20 minutes, whole class “river activity”
- 2 minutes, closing and assessment

Classroom Organization

Meet first as a whole class, then in groups of four to six, and then back to the whole class as you discuss the river. Eight or more groups work best.

Required Student Skills

Students must be able to work in groups with minimal supervision.

Major Objectives

Pre-class Set-up

See the Preparation Checklist (at the end of the Lesson Plan) at least two weeks in advance. Contact DSRSD Public Information (925-875-2282) for more information on materials that is available to borrow (including laminated category cards and “river” pieces).

Learning Statement

Students learn the cumulative effects of water pollution and the difference between point source and nonpoint source pollution. They will also be introduced to the idea of best management practices.

Behavioral Statement

The conclusions students reach at the end of the activity determine if the lesson has met the desired result.

Child Development Statement

Most students will be in Piaget’s Formal Operations stage and can use logic and scientific reasoning. *Sum of the Parts* is well suited to the average 6th grader’s cognitive abilities.

Vocabulary

Point Source Pollution (PS): Pollutants that are discharged from and can be tracked to an identifiable point or source, such as a particular discharge or sewage pipe (usually to the exact pipe).

Nonpoint Source Pollution (NPS): This occurs when the source of the contaminant is unidentifiable, that is, the contaminant can come from one of many places. Examples include runoff from farms, lawns, or urban streets.

Best Management Practices (BMP): Water and resource managers (leaders) use BMPs to describe land use measures that are designed to reduce or eliminate NPS pollution. Preventing oil from being dumped onto roads and using disposal sites for toxic chemicals are two examples of BMPs.

Delivery of Instruction

1. Set

Write “Sum of the Parts” on the board. Assemble all materials listed in Preparation Checklist (see end of lesson plan).

2. Warm-up

“Has anyone here ever been at the beach or a baseball game and noticed how there is trash all over the place? Do you think one person went in after all the people left and threw around a bunch of trash?” (No) **“The quality of our water is a lot like that beach or baseball park. Lots of people have an impact.”**

(Point to name of activity written on the board.) **“Next question: Why didn’t I spell the word ‘sum’ like this?”** (Write “some” on the board. Call on students; they will know why.) **“I want you to keep this in mind as we go through the activity. Let’s get started.”**

3. Teacher-directed instruction

“Let’s pretend your long lost uncle (or aunt) has just given you two million dollars and six acres of land along a beautiful, unspoiled stream. There’s just one catch: you must develop the land in order to collect the money. Develop means to use it for some purpose other than enjoying it in its natural state. Your uncle did not want you to just live an idle life. He wanted you to do something and get involved with your community. In other words, you can’t just sell the land for more money.

“So, we are going to work in groups and I’m going to give each group a piece of paper, (hold up a blank piece of paper) which will represent your group’s piece of land.”

4. Modeling/Guided Practice

Make a big square on the board representing the paper and explain how they will write their names and class period on the back of the paper. Draw another, slightly smaller, square inside the first square. **“You are going to be drawing a picture on your paper. Be sure to make the**

picture fill up the entire piece of paper, like this. Don't draw little, tiny drawings like this (illustrate on the board) because we will all need to see them later."

Ask the students what kind of businesses or other developments they might see along a river. Take some input and write them on the whiteboard or overhead (even if you will be handing out the optional category cards). Stop after you get about the same number of categories as the number of student groups (usually five to six).

"It is important to remember that you will not be drawing the river. We'll be placing the drawings of your businesses on the river I've constructed. (Point to it.) You are just to draw your parcel of land with the business on it." Divide the class into groups of four to six students and assign each group a number. Tell them you will be assigning each group a category off the board or handing them a category card. Do not let them choose the category. Tell them they will have five to seven minutes to draw their businesses. (You want to spend most of the time on the river activity and closure.)

5. Check for Understanding

Take any questions/clarifications. Do not get into discussion about specific businesses because you will do this as you move about the class during the drawing activity. Reiterate that they are not drawing the river by asking, **"Are any of you going to draw the river?"** (No) Make sure they understand to only draw a business that represents their assigned category.

6. Practice

Go to the first group, assign it the number one, and give them a piece of paper and a category card. Remind students to write their names, class period and group number on the back. Repeat for other groups. Note: It is helpful to somewhat "fix" the order of businesses by putting polluting businesses in the number one or number two position. Circulate around the room as students draw and provide clarifications and encouragement as needed

✓ *It is very important to leave at least 20 minutes for the river activity, in which students reach conclusions.*

7. Assessment and Closure (must have 20 minutes for this activity)

After the students have developed drawings of their land, have the whole class gather around the "river." One by one, have each group explain their development. As they explain, place small items that stand for different types of pollution on the group's property.

After all the groups have had a turn, explain how rivers all run one way, depending on which side of the Continental Divide they are on. Those on the east go to the Atlantic Ocean or the Gulf of Mexico and those on the west go to the Pacific Ocean. **"So the river's water and the pollution do not stay in one place. It moves as the river moves."** Move all pollution markers along as you move down the river until all the pollution is on one end of the river.

After you let the river “flow” and all the pollution is on the last two pieces of property, pick up one item that stands for “people pollution. **“Where did this particular one come from?”** Kids will joke but eventually someone will say they don’t know. Ask why. (It could have come from anywhere.) Explain how this is called nonpoint source pollution because we do not know where it came from.

Now take a marker that stands for uniquely identifiable pollution, such as oil. **“Where did this come from?”** Students will know and will point to or say the property with a gas station or oil refinery. Explain how this is called point source pollution and experts usually can determine exactly where it came from, right down to the pipe or tank, (or it can’t be called point source). **“Which type of pollution do you think is easier to regulate?”** (Point source) Answer yes that is true but, unfortunately a lot of pollution is non-source point.

Now it’s time to ask questions:

“Do you think the person with the resort likes the fact that a power plant is right next door?”

“Does a person down the river have the right or power to tell a person up the river what to do?”

“What do you think happens when companies or cities disagree on the rivers’ uses? What about different states? What about different countries?”

As you ask these questions, you can further explain PS and NPS pollution, especially how one is easier to regulate than the other. You also can introduce the concept of best management practices (BMPs) and organizations like the Environmental Protection Agency. Explain why they are necessary.

End the lesson by pointing out the students will soon be voters, business leaders, and policy makers and will be the future stewards of the Earth.

✓ *Students respond very well to this lesson. Once they see the “pollution” moving down the river they understand the idea very quickly.*

Resources

Helpful Facts

- National Wild & Scenic Rivers System: Rivers and Water Facts <http://www.rivers.gov/rivers/waterfacts.php>
- EPA: What is Nonpoint Source Pollution? <http://water.epa.gov/polwaste/nps/whatis.cfm>
- How Dublin San Ramon Services District minimizes point source pollution locally: http://www.drsrd.com/doing_business_with_drsrd/pretreatpollprev.html

Resources Used in Developing Lesson Plan

- Coujcil for Environmental Education, Project WET Curriculum & Activity Guide (Bozeman, MT, 1995), 267-270.
- *Kids in Creeks*, teacher resource program formerly offered by The Watershed Project <http://www.thewatershedproject.org>

PREPARATION CHECKLIST

Important Note

At least two weeks in advance, contact DSRSD Public Information (925-875-2282) for more information on materials that is available to borrow (including laminated category cards and “river” pieces).

Pre-class Preparation – Two weeks ahead

- Arrange to borrow category cards, river pieces, and pollution markers from DSRSD if desired (see above).

Pre-class Preparation – A few days ahead

- Make a paper river using eight sheets of green and blue construction paper.
- Assemble bags of about five different types of small items to act as “pollution markers” (paper clips, binder clips, erasers, blocks, staplers [for big items], tiny flip-flops (good to represent people), etc.).
- Have on hand 8-1/2 x 11-inch paper, one piece per group.
- Print category cards (optional—printable files included with lesson plan).
- Print example drawings (optional—printable files included with lesson plan).