Reading the River 2006
Water Study
Sixth Grade Science
Mindy Fry
Kenton County

Curriculum Plan

Lesson Context:

To kick off this unit of study, I will have Jamie Egglemeyer from Sanitation District No. 1 come to my classroom to discuss the importance of water quality. The Sanitation district has a program that that coincides with this unit on water quality. This is the first lesson in a unit to assess a stream's water quality. In the first lesson, the students worked on the chemical composition of the water. They tested our classroom fish tanks for temperature, pH, dissolved oxygen, conductivity, turbidity, and harness, using the LaMotte testing kits. After the students tested our aquariums, we discussed and defined what each of the items we tested. The students will compile a list of vocabulary words for assessments at the end of the unit. In this lesson the student will study the macro invertebrates that live in streams. The students will use the Lamotte Macro Mania kit. The third lesson will focus on the physical habitat of the stream. The students will become familiar and learn to use the Habitat Assessment Field Data Sheet for High Gradient Streams. We will discuss in detail each of the ten parameters, but using a dry creek behind our school that goes into Bank Lick Creek. This lesson will take a few days to get through. Once my students are confident in their abilities to assess the physical, chemical, and biological composition of a stream, we will take a field trip to Sanitation District No. 1's Service Park in Kenton County. Bank Lick Creek flows through the park, many of my students play near this body of water on a daily basis.

Objectives:

- Students will assess their classroom fish tanks and Bank Lick Creek based on indicators of pH, water temperature, dissolved oxygen, and conductivity
- Students will be able to make inferences about Bank Lick Creek based on the chemical assessment.

Core Content:

SC-06-4.7.1

Students will describe the consequences of change in one or more abiotic factors on a population within an ecosystem.

PL-06-3.3.01
Students will describe consumer actions (reuse, reduce, recycle) and explain how these actions impact the environment (e.g., conserving resources, reducing pollution, reducing solid waste, conserving energy).

Materials:

1) Student journal
2) Open response question and rubric
3) LaMotte Chemical Testing Kit (contains pH, water temperature, dissolved oxygen, and conductivity)
4) LaMotte The Monitor,s Handbook

Procedures:

1) Review the importance of water quality with the students.
2) Discuss land use
    a. Undisturbed Areas --- tress and plants grow on the banks of streams (buffer). They protect the habitat of the stream by offering shade to keep water temperature low, leaves that fall provide food and shelter, and the roots of the plants keep the banks strong (helps to keep the banks from eroding).
    b. Rural Areas --- streams flow through farmland. Trees and plants are cut down to make more areas for planting. Since there is a lack of trees, the water is warm, there are no leaves to offer food and shelter, and the banks erode into the streams. Farmers put fertilizer on their crops to help them grow. The fertilizer will run into the stream when it rains causing algae to grow out of control. Farm animals also go to the streams to drink and cool of causing the banks to fall into the streams. The loose soil and animal poop wash into the stream coving the bottom where macros live.
    c. Urban Areas --- trees and plants are removed from the banks to create room for highways, factories, and construction of buildings. Many natural waterways are replaced with concrete-sided waterways and the water is diverted to factories and underground pipes. After the water is used it is replaced in a different part of the stream. The water is usually warmer and polluted. During rainstorms, garbage on the streets, oil from cars, and animal poop flows into storm drains that lead directly to streams.

3) We know that land use affects water quality, but we often want to measure how much the water quality has been affected. Water quality can be measured in three ways.
    a. Chemical (which we discussed in the last lesson) --- temperature, pH, dissolved oxygen, conductivity,
    b. Biological (which we will discuss today) --- biology living in the streams.
    c. Physical (which we will discuss in the next lesson) --- what the habitat looks like.
4) You will need to explain the following items to the students. . Water temperature in the stream is one factor in determining which species may or may not be present because temperature affects metabolism, reproduction, and even the feeding habits of aquatic animals. Problems can occur in the stream even if the temperature is high for only one or two weeks during the year. The best pH range for most aquatic organisms is between 6.4 and 8.3. The pH measurements must be made at the stream because the pH of a sample will rapidly change. Aquatic animals must have dissolved oxygen (DO) to live. The amount of dissolved oxygen in the water is limited by factors such as the temperature and salinity of the water. Fish cannot live in water with dissolved oxygen levels at 2 ppm or lower.
5) Measuring Air and Water Temperature
    a. Measure air temperature first.
    b. Place thermometer in a convenient location and wait several minutes.
    c. Check and record temperature.
    d. Place lower half of thermometer in water for 1-2 minutes.
    e. Check and record temperature.
6) Measuring pH
    a. Fill the test tube to the 5.0 line with water.
    b. Add 10 drops of Wide Range Indicator solution.
    c. Cap and mix.
    d. Insert test tube into Octet Comparator.
    e. Match test tube sample color to a color standard.
    f. Record pH number.
7) Measuring Dissolved Oxygen
    a. 1. Fill Water Sampling Bottle.
    b. Add 8 drops of Manganese Sulfate Solution.
    c. Add 8 drops of Alkaline Potassium Iodide Azide. Cap and mix. Allow precipitate to settle.

d. Use the 1.0G spoon to add Sulfuric Acid Powder.
e. Cap and mix until reagent and precipitate dissolve.
f. Fill test tube to the 20 ml line.
g. Add 8 drops of Starch Indicator.
h. Fill titrator with Sodium Thiosulfate.
i. Titrate until blue color just disappears and solution is colorless.
j. Read result in ppm Dissolved Oxygen.
k. Record number.

8) Measuring Conductivity
    a. Remove electrode cap.
    b. Press on/off button to turn unit on.
    c. Dip electrode into water. Make sure sensor is covered.
    d. Wait 1 minute for reading to stabilize.
    e. Press hold button.
    f. Record number.
    g. Press on/off button to turn unit off.
9) The students will practice using the LaMotte testing equipment in my classroom.
10) They will work in groups of three or four to test the chemical water quality of our fish tanks, water samples from a nearby pond, and a creek that runs in my backyard.
11) The students will place all the data that they collected in a handout (see assessment section)
12) Questions to ask to have the students explain their data.
    a. What differences did you find? Explain.
    b. What similarities did you find? Explain.
    c. How did the water quality at the different sites compare?
13) This will help to prepare the students for their trip to the Service Park at Sanitation District No. 1.

Explanation:

1) Assess the water quality of a stream based on the chemical composition.
2) Explain how the land use affects water quality --- increased contamination/ pollution from everyday and industrial use, Greater erosion on land near river due to residential and commercial development, fecal runoff causing diseases, ecosystems disturbed, less natural beauty, larger amounts of runoff in watershed, and more flooding zones

3) Ways to keep our stream clean --- Adopt a stream and look for pollution problems, organize a stream trash cleanup, tell your parents when you see pollution problems, plant trees along the stream to provide shade and stabilize stream banks, clean up your backyard and ask your parents to use less pesticide and fertilizer, clean up after pets, don't litter, recycle oil and household chemicals.

Assessment:

Data sheet for Chemical Quality

Time	Location	Air Temp. (*C)	Water Temp. (*C)	PH (S.U.)	Dissolved Oxygen (mg/L)	Conductivity (umho/cm)
	Fish Tank					
	Pond					
	Creek					

1) Individual assessment based on how they performed in the group.

CATEGORY	*4*	*3*	*2*	*1*
Contributions	Consistently participates	Usually participates	Sometimes participates	Rarely participates
Quality of Work	Excellent	Good	Fair	Poor
Time-management	Consistently uses time well	Usually uses time well	Sometimes uses time well	Rarely uses time well
Attitude	Consistently enthusiastic and positive	Usually enthusiastic and positive	Sometimes enthusiastic and positive	Rarely enthusiastic and positive

2) At the end of the unit the students' journals will be assessed.

	Beginning	Developing	Competent
Activity Objective	The objective of	The objective of	The objective of

	most class activities is not clearly and/or accurately stated	most class activities is clearly and accurately stated.	each class activity is clearly and accurately stated
Activity Procedures	The activity procedure for most class activities is not clearly and/or accurately stated.	The activity procedure is clearly and accurately stated.	The activity procedure for each class is clearly and accurately stated
Activity Data	The data for each class activity in not clearly and/or accurately stated.	The data is clearly and accurately stated.	The data for each class is clearly and accurately stated.
Activity Conclusion	The conclusion for each class activity in not clearly and/or accurately stated.	The conclusion is clearly and accurately stated.	The conclusion for each class is clearly and accurately stated.
Activity Questions	The questions for each class activity are not clearly and/or accurately answered.	The questions are clearly and accurately answered.	The questions for each class are clearly and accurately answered.
Organization	The journal doesn't contain most of the headings and sub-headings identified in the left hand sections	The journal contains most of the headings and sub-headings identified in the left hand sections	The journal contains clear headings and sub-headings identified in the left hand sections

References:

1) Course Handbook --- Aquatic Ecology for Teachers --- Summer 2005
2) Course Handbook --- Reading the River --- Summer 2006
3) LaMotte Testing Kit for Chemical Assessments
4) www.rubistar4teachers.org