Water Quality Testing – Lesson Plan

Objectives

- Students will be able to (SWBAT) visualize the Chesapeake Bay watershed by creating a topographic map of the watershed and describe the flow of water and pollutants through the watershed by using their model to test where the water flows.
- SWBAT identify and discuss potential sources of pollution from around the Chesapeake Bay watershed by analyzing a land use map.
- SWBAT test the following water quality parameters: temperature, nutrients (nitrogen and phosphorus), turbidity, pH, and dissolved oxygen and eventually compare these data to results from testing the pond throughout the year. Students will read about these water quality parameters and then be able to determine the health of the water by analyzing their data.
- SWBAT collect and identify freshwater macroinvertebrates by dip netting and using an identification sheet. Students will use these data to further support their previous analysis of water quality based on physical and chemical tests.
- It is important for students to learn about their physical position in the watershed, so that they realize their daily actions can have an impact, either positive or negative, on the health of the watershed. This inspires them to think before they act, consider long-term implications of their actions, and hopefully make better decisions. This is all part of becoming geo-literate. Conducting water quality tests in a manmade retention pond, shows students an example of low-impact design and demonstrates that there are ways to mitigate negative effects of development, even on a small scale.

Water quality lesson outline:

Activity 1. Watershed Address (15 min)

1. Ask students where do you live?
    - Start small, ex. street address and move to bigger classifications, ex. State and Country. Develop this into a discussion about our "watershed address." (5 minutes)
2. Use a tarp with the outline of the Chesapeake Bay watershed to form a large topographic map of the Bay watershed.
    - Students stand on the outside of the tarp and lift the tarp up to a height depending on their location in the watershed. Example: upstate NY and PA will be higher than MD and DE. Make sure the tarp is large enough for all students to participate.
    - Give one student a spray bottle and have them introduce water to the map and describe where the water goes. Discuss runoff and potential sources of pollution around their home and school, plus around CBEC. Use laminated land-use map of the Chesapeake Bay watershed to identify sources of pollution based on type of land use.
    - Add "pollution," aka food coloring, in the watershed, rain over that area, and see where the pollution travels. (10 minutes)

Activity 2. Observing the freshwater pond environment (10 min)

1. How can our actions in our local watershed affect the Chesapeake Bay?
2. Introduce students to the assignment – "We are going to test the water quality of a manmade pond on this property. If this pond was not here, all of the runoff from this area would headed for the marsh and then into the Bay."
3. Break students into 4 groups. Pass out Student Packet.
4. Guide students to walk quietly around the pond by the aviary.
    - Have them observe their surroundings and make a hypothesis about the quality of the water.
    - Record hypothesis in Student Packet.

Activity 3. Macroinvertebrate Study (20 min)

1. Explain assignment to students
    - Macroinvertebrates are invertebrates (animals without backbones) that are able to be seen with the human eye (unaided by microscopes, therefore "macro").
    - Scientists collect and study macroinvertebrates to analyze water quality. Some macroinvertebrates are tolerant to pollution – meaning they are not very sensitive to pollution and usually don't require a lot of dissolved oxygen. Other organisms are very sensitive and require very good water quality.
    - If we collected macroinvertebrates from a pond and only found tolerant organisms, what would this mean about the quality of this water? If we found several tolerant organisms and several sensitive organisms, what would this mean?
2. Follow directions in the Student Packet. Have one student read the directions to the entire class.
    - Demonstrate how to use the dip net and how to look CLOSELY for any macroinvertebrates.
3. Groups spread out and collect macroinvertebrates. (15 min)
    - Identify and rate the water quality using the key in the Student Packet.
4. Bring organisms (in ice cube trays) to table at the starting location. Share with all students.
5. Discuss results – looking at our data, is the water quality excellent, very good, good, fair, or poor?

Activity 4. Water Quality Testing (20 min)

1. Explain assignment to students
    - Another way to analyze water quality is to do physical and chemical tests. We will test the temperature, dissolved oxygen, pH, and turbidity of the water.
2. Students are already in 4 groups. Each team is in charge of one of the water quality tests. The directions for their test is in their packet.
3. Have students read the directions on the Student Packet which tells them to read the background information for their test and then predict what their results will be.
4. Pass out water quality test kits.
5. Students conduct tests (oxygen test will take the longest – 10 minutes). Fill out results in Student Packet.
6. While waiting for oxygen test to finish, students start sharing results.
    - Each group will present background information about their parameter, why a healthy level of this is important, and the results.

- For example, “pH is the amount of acid in the water and most animals are adapted to a specific range of pH. If the water is too acidic or basic, the animals will die. Our pH was 8, which is safe for aquatic animals.”

Conclusion and Evaluation

Discuss each groups’ analysis of water quality, being sure that they use their observations and data from the macroinvertebrate study and water quality tests to support their analysis.

- Students will determine the health of the water by conducting water quality tests, creating a written statement as to the quality of the water using data to support their analysis, and then discussing their results. Students will do this in small groups at first, where chaperones can make sure all students are participating in the determination, and then in a class group where I can call on individuals to explain how their group came about their decision.

Materials:

Student Packet (4)
Lesson Packet (4)
Pencils

Tarp with outline of CB
Spray bottle
Food coloring

Table
Dip nets (8)
Bucket (8)
Ice cube trays (4)
Container of clear water (soda bottles – 4)
Tweezers (8)
Magnifying glasses (4)

Water quality testabs, thermometers, etc. Materials for each test stored in a gallon-sized baggie.