Lesson Plan 3
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Introduction to Testing Water Quality Parameters

Objectives:

The objective of this lesson plan is to use multiple activities to engage students in exploring the relationships between human impacts and water quality. This lesson will introduce students to different water quality parameters, explain how parameters are tested, and introduce testing equipment and data analysis that will assist students in making connections between different land-use activities and water quality. In addition, students will explore and determine possible solutions to issues related to a given land-use types impact on water quality resources including stormwater best management practices and Low Impact Development techniques.

Materials:

Materials necessary to complete this lesson include the following: Access to the Internet, Vernier labquest data collection unit and probes (there are various probes that may include dissolved oxygen, nitrogen, temperature and pH), various water samples (these can be made or samples can be taken from a local stream/river), waders if samples are taken from a stream/river, and Microsoft Office (e.g. Excel, PowerPoint and Word) software. Water quality sampling strips for multiple parameters are available at fish stores instead of purchasing a Vernier labquest unit and probes. If multiple water quality samples have not been collected to produce a dataset, a class could use the Environmental Protection Agency (EPA) STORET database and United States Geological Survey (USGS).

> Venier Labquest Units:
> http://www.vernier.com/products/interfaces/labq2/
>
> EPA STORET:
> http://www.epa.gov/storet/dbtop.html
>
> USGS Water Data:
> http://waterdata.usgs.gov/nwis
>
> GK-12 Greenway Water Quality Data:
> http://gk12.uncg.edu/stream_data/
>
> Low Impact Development (LID) Techniques:
> http://water.epa.gov/polwaste/green/index.cfm
>
> Stormwater Best Management Practices (BMPs):

Warm-up Procedures:

- Write "Water Quality" on the board and ask students to describe what processes could harm water quality (e.g. factories, development, etc.) and have each student develop their own definition. Revisit these definitions once the lesson is completed and ask students how they would revise their definition.
- Ask students why clean water resources are important?
- Break students into small groups and ask them to list all of the way they used water resources in the last day (24 hours)? Also have them list the ways in which wildlife use water resources.

Cultural Connection:

- Ask students to research how different cultures use water resources. The United Nations Water Program is a great place to start. Ask students "How do different cultures use water resources and how do they compare and contrast with the list your group developed above?"
- United Nations Water Program Website: http://www.unwater.org/

Procedures:

- Show students a PowerPoint that has each of the water quality parameter definitions and have students take notes. Ensure that the PowerPoint slides include a clear definition; examples of what types of land-use activities may include these parameters (i.e. pesticides are typically associated with agricultural land uses and increases in nitrogen and phosphorous), and what levels are expected to ensure that aquatic life is healthy. Include possible solutions to improving water quality pollution such as stormwater best management practices (e.g. bioretention areas, rain gardens, etc.) and Low Impact Development techniques that assist in mitigating surface water impairments.
- Review testing procedures including how equipment should be handled, how to clean and store and units as well as some of the pitfalls to collecting data in the field (i.e. back up batteries, dressing for adverse weather conditions, etc.).
- Review how to record data using Microsoft excel and how to develop graphs using a dataset.
- Using multiple water samples, introduce students to the Vernier labquest unit(s) by showing them the unit's features (e.g. graphing features), how to connect probes, calibration procedures, and how to place the probes in the samples. Also note how the units should be cleaned when testing multiple samples.
- Have students work in groups to practice calibrating the probes. Vernier units and probes come with details of how to calibrate, clean and store units. Students can use the manual to guide them through these procedures.
- Give one water sample to each group, have them test the samples using multiple probes and document their findings.

- Using the notes taken during the PowerPoint presentation, ask each group to compare their results with the definitions for each parameter. Select a presenter from each group and have them present their findings to the class. As the class to discuss why types of land-use activities may have influenced their results and what implications it has for aquatic species and surface water quality.
- Given the school's location, ask students what they would expect the water quality to be in local stream/river systems based on the surrounding land-use. Google map (satellite version) and Google Earth can help students identify land-use patterns around the school's campus.
- Using the LID and BMP websites listed above, ask students to select 2-3 BMPs that could be implemented on the school's campus. Have student develop a one page proposal describing the BMPs, where and why they should be located on campus and the benefits to surface water resources.

Lesson Plan Extensions:

- Using the EPA and USGS water quality databases, have student select a water quality testing location and 2-3 water quality parameters. Based on the stations location, have students develop a hypothesis that addresses what they expect to find during their data research, collection and analysis procedures.
- Ask students to work in groups use Excel to graph their findings for different water quality parameters.
- Use Google Earth to identify the location of the water quality station and ask students to characterize the surrounding land-use patterns.
- Have groups present their findings to the class using PowerPoint or other presentation tools. The presentation should include the characteristics of the land-use patterns surround their selected water quality station, a brief description of the parameters they selected and what patterns they found, if any, in their analysis of the data. Also, have students consider the season influences on water quality parameters.
- In concluding their presentation, ask students what BMPs would be best to implement in their selected location.