Testing Watershed Quality

ELO Title: Testing Watershed Quality

School: Pinkerton Academy

Essential question: How can chemical data, biodiversity and trophic state be used to determine overall water quality and how the water quality can be improved?

Area(s) of study: Biology/Science

Type & amount of credit: ½ credit. Students worked together when doing the trials (on another lake) and collecting the data at the final site, but their final projects were individual.

Competencies:

Short description	Full text of competency
Significance of changes	Students will demonstrate the ability to describe and represent the significance of changes in observable and non-observable phenomena in terms of relative scale, proportion, and quantity.
Static and dynamic conditions	Students will demonstrate the ability to investigate and analyze static and dynamic conditions of natural and human designed systems in order to explain and predict changes over time.
Mathematical representations	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
Human impact on the environment	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Student Activities:

1. Week 1 - Explore the problem. The students will be asked to become a consultant for the town to analyze, review all situations (good and bad), and explain to the town council the impact, solutions, and recommendations needed to clean up the water. Participate in demonstration on what a watershed is. Examine a map of the watershed of the trial water (Beaver Lake). Research the seven chemical parameters/thresholds for fresh water quality and test trial water for those parameters (practice)
2. Week 2 - Play macromania game to understand how benthic macroinvertebrates (bugs) can indicate water quality and complete a reading on it (bioindicators). Test trial water for bugs to determine a biotic index value.

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3. Week 3 - Trophic states of water. Analyze the chemical and bug data and make a conclusion for the trial water (make slide show). For chemical data, make sure to get rid of outliers. Do a virtual drive through of the trial water's watershed roads and determine possible pollutants. If improvements were to be made to improve the water, based on the watershed drive through, what would they be and why?
4. Week 4 - Field trip to Big Island Pond. Take field trip to collect chemical and bug data and begin analyzing data.
5. Weeks 5 and 6 - Analysis and conclusion. Given a map of the tested water's watershed, and virtually driving down the streets in the watershed, determine the probable pollutants. Determine the sources of the water quality deficits using a watershed map and make a plan to improve the quality which explains how humans impact the environment.

Community partner: Friends of Big Island Pond. Friends of Big Island Pond is made up of individuals that live on/around the pond who have a vested interest in the preservation and conservation of the lake. One of their goals is to help students become stewards of the environment.

Community partner responsibilities for this ELO:
The Friends of Big Island Pond have paid for our testing equipment (everything from waders and chemical probes to dish pans) as well as bus transportation twice a year (the course is half a year so is offered twice). They set up ability to go to the testing locations with the landowners. One of the board members always joins us at the testing sites, and, when possible, others involved will also come to a site and talk with the students.

Assessment:
DoK-4 (Create) is the highest level of Webb's Depth of Knowledge. At this level, students can think extensively about what else can be done, how else can learning be used, and how could the student personally use what they have learned in different academic and real world contexts (knowledge augmentation). DoK-4 is extensive and practical, focusing on how and why learning can be transferred and used across the curriculum and beyond the classroom

Assessment questions:

1. Was the analysis accurate? (Did they calculate correctly? Did they take out outliers? Did they put the bugs into the correct categories to determine biotic index?)
2. Did the conclusion for each site and the overall lake make sense? For example, if 5 out of 7 chemical tests came back poor and bug data came back poor, yet they said the water was "good" - I would question how they got that. I looked for evidence that they used to help support their statement.
3. Did students have solid solutions or recommendations to help improve the water? I was looking for what they found in their watershed drivethrough, how they determined the major pollutants, how the pollutants would impact the water and what their suggestions were on trying to reduce those pollutants.

Final Presentation was to the Big Island Pond members as to the health of the pond and recommendations for improvement.

Connection to student's measureable postsecondary goals:
This is an elective course, so some students are interested in jobs in the environmental field, which this satisfies.

Comments and suggestions for other schools implementing a similar ELO:
Getting permission to take samples from various locations around the fresh water would be great. I have tried this with all different kinds of probes, but found them cumbersome in the field, so have gone back to Hach chemical tests for most of the testing. The "Friends of Big Island Pond" support our program, and pay for us bus, so if the lake/pond has an association, they might be able and willing to help with some costs.

Are you willing to be contacted by another school interested in developing something similar to this?
yes. JRoy@PinkertonAcademy.org or KiSoroko@PinkertonAcademy.org

Supporting material

- Original ELO plan
- Week 1 materials
- Week 2 materials
- Week 3 materials
- Week 4 - Chem and bug field trip data sheet
- Weeks 5-6 materials
- Student work. See Weeks 3 and 5-6.
- Video of making a watershed map (no narration)

Photos or student work submitted:
__JR_ Permission is granted to use these on the BeyondClassroom website. (Please initial)