

Macroinvertebrate Lesson

Why is there a difference between the macroinvertebrate population at [omitted] Park and the [omitted] Trail sites located along [omitted] Creek?

I. Subject Area

Chemistry

II. National Standards

- a. Content Standard F: Science in Personal and Social Perspectives
Environmental Quality:
 - i. Natural ecosystems provide an array of basic processes that affect humans. . . Humans are changing many of these basic processes, and the changes may be detrimental to humans.
 - ii. Materials from human societies affect both physical and chemical cycles of the earth.
- b. Content Standard B: Physical Science
Chemical Reactions:
 - i. Chemical reactions occur all around us, for example in healthcare, cooking, cosmetics, and automobiles. Complex chemical reactions involving carbon-based molecules take place constantly in every cell in our body.

II. State Standards

- a. Strand 3, Concept 1, PO 2 Describe the environmental effects of the following natural and/or human-caused hazards: pollution
- b. Strand 3, Concept 1, PO4 Evaluate the following factors that affect the quality of the environment: urban development
- c. Strand 5, Concept 4, PO11 Predict the effect of various factors (e.g., temperature, concentration, pressure, catalyst) on the equilibrium state and on the rates of chemical reaction.
- d. Strand 5, Concept 1 PO 2 Describe substances based on their chemical properties.

III. Key Skills

- a. Information: Acquire and evaluate data
- b. Computing: Use computers to process information
- c. Critical thinking and doing: problem solving, research, analysis, project management.
- d. Communication: Use media effectively to communicate results

IV. Habits of Mind

- Questioning and posing problems

V. Lessons

- a. Launch – review previous data collected and conclusions
- b. Research Environmental Variables
- c. Create Poster with key findings from research paper
- d. How to use Labquests
- e. Analyzing Data using ArcMap – [omitted] Fire Exercise
- f. Write procedure for data collection
- g. Collect Data on Variable
- h. Adding Data to ArcMap
- i. Analyze Data and Form Conclusions
- j. Power point presentation

VI. Statement of Problem

Human practices can affect factors critical to the health of ecosystems. These practices include but are not limited to development, farming, mining, water usage and recreation. Do the communities of [omitted] affect the ecosystem of [omitted] Creek? So far we have discovered that macroinvertebrates, biological indicators of ecosystems, have a smaller and less diverse population near [a park and] another site along [omitted] Creek located outside of town.

Why is the macroinvertebrate population at [omitted] Park smaller and less diverse than other areas along [omitted] Creek?

VII. Performance Objectives

- a. Students will research how their assigned environmental variable affects ecosystems using classroom and online resources.
- b. Students will create a poster displaying key findings from their research paper.
- c. Students will write a procedure on how they will collect data.
- d. Students will collect and organize data on their assigned environmental variable using a Labquest.

- e. Students will produce a map with data they collected using ArcMap.
- f. Students will form a conclusion based on their research and data analysis on why there is a difference in the macroinvertebrate population [between two sites].
- g. Students will present their maps and their findings using a Power Point presentation.

VIII. Map the Project

Knowledge and skills needed	Already have learned	Taught before proj.	Taught during proj.
1. Navigating GIS (basic)	X	X	
2. Ecosystems	X		
3. Geochemical Cycles		X	
4. Elements & Compounds		X	
5. Chemical Reactions		X	
6. Environmental Pollutants		X	
7. Research and gathering information			X
8. How to use Labquests	X		X
9. Testing water samples/ collecting data in the field			X
10. Adding data to ArcMap	X	X	X
11. Analyzing data/looking for patterns			X
12. Making a claim and presenting it			X

IX. Implementation Schedule of Lessons

- Week 1
 - Day 1: Launch - Review last year's data and results, handout project outline
 - Day 2: Variables are assigned. Bibliography tips. Students begin research.
 - Day 3 & 4: Research Papers. Teacher goes over how to use a Labquest with individual students.

- Week 2
 - Day 1: Students make a poster listing key findings about their variable to share with the class. Students take notes on the posters.
 - Day 2: Students organize materials needed for data collection. Students write out their procedure for data collection.
 - Day 3 & 4: Field Trips to Creek to collect data. Data is put into a spreadsheet.
- Week 3
 - Day 1: How to analyze data using ArcMap –Fire Exercise
 - Day 2: Computer Lab – Students begin making their maps, adding data and organizing it with teacher guidance. Adding Data directions
 - Day 3 & 4: Students work on finishing their maps and making power points.
- Week 4 -5
 - Day 1: Finish up Power point and add map to power point. How to Save map as a jpeg
 - Day 2 & 3: Make power point presentation

X. Manage the Process/Differentiated Instruction

Lessons will be delivered using various teaching techniques that cater to different learning styles. These include but are not limited to use of visual aids, modeling, and guided practice.

XI. Procedure Students will Follow to Create Deliverables

- a. Write a research paper on assigned environmental variable (chemical pollutant)
- b. Create a poster with key findings on assigned variable to share with other students. Take notes on other posters so you have some background on other variables when making claims.
- c. Write a procedure for collecting data in the field
- d. obtain data on assigned environmental variable from the field using test kits and Labquests
- e. add data to excel spreadsheet , teacher adds data to geodatabase
- f. add data from geodatabase to ArcMap
- g. add field collected data to ArcMap
- h. conduct analysis

- i. form conclusions
- j. create presentation that includes research, findings (maps)and conclusion

XII. Data Collection

a. Data – Student Collected variables

- i. Water pH
- ii. Phosphate concentration
- iii. Nitrate concentration
- iv. N:P ratio
- v. Dissolved oxygen
- vi. BOD (biochemical oxygen demand)
- vii. Temperature
- viii. Turbidity
- ix. Depth
- x. Hardness
- xi. Copper
- xii. chlorine
- xiii. fish/crayfish

b. Data – Online sources

- i. Aerial Imagery
- ii. Public
- iii. Landcover
- iv. Slope
- v. Hillshade
- vi. Golf courses
- vii. Farms
- viii. Pavement
- ix. drainage

XIII. Analysis/Evaluation

Creek Analysis Using GIS

	4. Distinguished	3. Proficient	2. Apprentice	1. Novice
<p>Lab Work-Data Quality: Accurate measurement and labeling (Excel Spreadsheet)</p>	All data was complete and accurately labeled. Data was preprocessed correctly for GIS.	All data was complete and accurately labeled. Attempted to preprocess data for GIS.	Data was incomplete. Some data was not labeled using appropriate units of measure. Data was not preprocessed for GIS.	Included little or no relevant data. Data was not preprocessed using GIS.
<p>Lab Work-Data Display: Data is displayed using graphs, charts, and tables (Map)</p>	Pertinent data was added correctly to an ArcMap document. Features/layers are labeled and easy to distinguish from one another.	Pertinent data was added correctly to an ArcMap document. Features/layers are labeled.	Unpertinent data was added correctly to an ArcMap document. Features/layers are labeled.	Data was not added correctly to an ArcMap document or data is missing. Features/layers are not labeled.
<p>Lab Work-Data Analysis: Student analyzed data and identified trends (Final Assessment Power Point)</p>	Identified and described patterns. Made appropriate conclusions based on the data. Used ArcMap document to support conclusion.	Identified and described patterns. Made conclusions based on the data. Limited use of ArcMap document to support conclusion.	Only identified obvious patterns or found patterns not fully supported by the data. Limited use of ArcMap document to support conclusion.	Patterns were missing or were not supported by the data collected. Obvious patterns were overlooked.
<p>Research-Overview: Quantity, quality,</p>	Paper is at least one page in length and clearly describes topic. Project	Paper is at least one page in length and clearly describes topic. Project	Paper is less than one page in length or vaguely describes topic. Project	Paper is less than one page in length or vaguely describes topic. Bibliography or

and documentation (Research Paper)	bibliography or credits were complete.	bibliography or credits were missing or incomplete.	bibliography or credits were complete.	credits were missing or incomplete.
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XIV. Deliverables

- a. .mxd (ArcMap document)
- b. PowerPoint Presentation