Data Visualization Best Practices Workshop Teacher Report

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Area(s) of Teaching: Chemistry, Dual enrollment chemistry 103 (RIC), Oceanography

Where You Teach: Mt Pleasant High School

Please describe your activity goal:

NASA Globe Urban Heat Island Protocol: "How does surface cover affect surface temperature?

Purpose

The purpose of this investigation is to discover how the land cover of the ground affects its surface temperature. The main research question that needs to be answered is "How does surface cover affect surface temperature?" Students can set up research studies at their own school such as looking at the difference between paved and unpaved areas, such as a grassy area. More schools are taking surface temperature observations; therefore, students can investigate how surface temperature changes between schools. They could look at elevation, latitude and longitude, urban versus rural, proximity to water, etc. There are many research questions possible with surface temperature. Students could also look at how cloud cover or humidity affect the surface temperature.

Overview

Urban Heat Island Effect-Surface Temperature Field Campaign is focused on looking at the impact urbanization has on the Earth's surface temperature and how the surface temperature changes the dynamics of the Earth's atmosphere. Studying the energy cycle is fundamental to understanding how the Earth's spheres function within its system. The surface temperature measurements contribute data a) not normally collected by weather agencies, b) for climate studies and c) for ground-truthing satellite data.

What is the intended visualization?

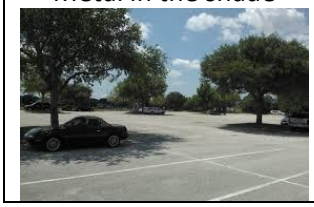
By interacting with various visualizations (i.e., images, charts, and graphs), students explore the *urban heat island effect* using land surface temperature and vegetation data. Students will investigate the processes that create differences in surface temperatures, as well as how human activities have led to the creation of urban heat islands.

Please provide the activity wordings presented to the students:

Documents provided:
Urban Heat Protocols
Surface Temperature Scavenger Hunt Data Table
Presentation for special needs or elementary students
Worksheet that follows includes pictures for MLL or non-readers.
https://drive.google.com/drive/folders/1n74cvXb-7onDyA_9OwccWl2-xwjm1gXQ?usp=sharing

Your Group's Mission: Locate one of each surface type and condition (in the sun or in the shade) in the table below and record the surface temperature.

Surface Substrate	**Surface Temp 1 (°C)**	**Surface Temp 2 (°C)**	**Surface Temp 3 (°C)**	**YOUR Group's average Surface Temp (°C)**	**CLASS DATA (record <u>averages</u> from each group)**	**CLASS Average Surface Temp (°C)**
Grass in the sun 					1._____ 4._____ 2._____ 5._____ 3._____ 6._____	
Grass in the shade 					1._____ 4._____ 2._____ 5._____ 3._____ 6._____	
Outdoor wall in the sun 					1._____ 4._____ 2._____ 5._____ 3._____ 6._____	
Outdoor wall in the shade 					1._____ 4._____ 2._____ 5._____ 3._____ 6._____	
Bare dirt in the sun 					1._____ 4._____ 2._____ 5._____ 3._____ 6._____	
Bare dirt in the shade 					1._____ 4._____ 2._____ 5._____ 3._____ 6._____	

Asphalt (blacktop) in the sun 					1._____ 4._____ 2._____ 5._____ 3._____ 6._____	
Asphalt (blacktop) in the shade 					1._____ 4._____ 2._____ 5._____ 3._____ 6._____	
Metal in the sun 					1._____ 4._____ 2._____ 5._____ 3._____ 6._____	
Metal in the shade 					1._____ 4._____ 2._____ 5._____ 3._____ 6._____	

Use Google Sheets or Microsoft Excel to create a bar graph of YOUR GROUP'S AVERAGE temperature data.

Please describe the nature of the activity (e.g. In class activity? Homework? Something else) and the rationale behind your choice.

Students learn best by doing, so this activity depends on student collected data. Students go outside at least 5 times during the school year and collect data during the fall, winter and spring comparing surface temperatures of different materials. Surface temperature measurements are entered in the NASA Globe Urban Heat Island App on any cell phone. From values collected in local microclimates, students can infer global effects of surface materials and of human impact on local temperatures.

Were students engaged?

Students were engaged in collecting data. Students learned to construct data tables in Google sheets including calculating averages of multiple data sets and graphing the average values collected.

What is/are the dataset(s) that will be used for the activity? How students will access the dataset(s)?

Student generated data sets will be used in addition to data in the NASA Globe Urban Heat Island Storylines: https://nasa.maps.arcgis.com/apps/MapSeries/index.html?appid=44b9c8738f0e47e68d9e8ae2c530ed08

What tool(s) are students going to use? How will students have access to the tool(s)?

Students will use digital IR thermometers for surface data collection and use digital thermometers for air temperature measurements. Students may also complete ground temperatures at 5 and 10 cm using mallets and nails. Relative humidity will be measured with wet and dry bulb thermometers or digital devices. All equipment is available through the NASA Globe program.

How you are going to grade the activity? (e.g. Rubric)

Scientific Method Skill: Summarize initial observations and background information in the introduction	E	M	A	FFB	Revise
• The introduction is easy to understand. • The introduction accurately summarizes all definitions and important ideas from published sources provided in class and from sources found independently • The introduction summary is well developed, detailed, and describes connections between ideas. • The introduction includes observations from previous related labs and activities. • The introduction is written in a paragraph format, including topic sentence(s), supporting sentence(s), and transitions.	Comments:				
Scientific Method Skill: Identify the independent variable	E	M	A	FFB	Revise
• The independent variable is actually the part of the experiment that is being changed. • The independent variable is complete and accurate. • The independent variable is listed and <u>not</u> written as a complete sentence.	Comments:				
Scientific Method Skill: Identify the <u>dependent variable</u>	E	M	A	FFB	Revise
• The dependent variable is actually the part of the experiment that is being measured as results. This is the "effect" that will be compared later in the conclusion. • The dependent variable is complete and accurate. • The dependent variable is listed and <u>not</u> written as a complete sentence.	Comments:				
Scientific Method Skill: Identify <u>experimental controls</u>	E	M	A	FFB	Revise
• Most of the materials, parts of the set up, and procedures of the experiment that stay the same are listed as experimental controls. • The experimental controls include strategies for how the dependent variable will be measured consistently, or the same each time. (Process, not just materials.) • The experimental controls listed are significant, meaning that the results could be affected if these parts of the experiment weren't controlled. • The experimental controls <u>do not</u> include either the independent or dependent variables. • The experimental controls are detailed. • The experimental controls do not say "same" before each control.	Comments:				
Scientific Method Skill: Ask an appropriate <u>question</u>	E	M	A	FFB	Revise
• The question accurately asks what you are trying to find out by doing the experiment. • The independent variable and dependent variable are included in the question. • Only one question is asked at a time. • The question ends in a question mark. • The question cannot be answered with a yes or no.	Comments:				

Scientific Method Skill: Make a logical <u>hypothesis</u>	E	M	A	FFB	Revise
• The hypothesis answers the question asked in the experiment. • The hypothesis clearly shows how the independent var. affects the dependent variable. • The hypothesis does not say "I think", "my hypothesis is", or any variation of those. • The hypothesis does not say "because" or does not explain the hypothesis in any way. • The hypothesis is written as one complete sentence. • The hypothesis is written in future tense (for example saying "will" instead of "did")	Comments:				
Scientific Method Skill: Design an <u>experiment</u> to test a hypothesis	E	M	A	FFB	Revise
• The materials list is a detailed and complete list of all materials needed to do experiment. • The hypothesis is appropriate for the type of data measured. (Shows a relationship between the IV and DV only if one can be made from the type of data measured.) • The procedures are easy to follow, logically ordered instr. for how to do the experiment. • The procedures are complete. • The procedures test the stated hypothesis. • The procedures are numbered down the left margin. • The procedures have been edited so they exactly match how the experiment was actually performed. • The procedures are written in complete sentences. • The procedures tell the reader to repeat the experiment several times for accuracy.	Comments:				
Scientific Method Skill: Organize and record results in a <u>data table</u>	E	M	A	FFB	Revise
• The results are organized into a data table that follows the standard scientific format. • The data table has a descriptive title: includes the independent and dependent vars. • The column and row labels are detailed and accurate descriptions of what information can be found in them. • The data is accurately recorded into the data table. • The experiment was repeated several times to check the accuracy of results. • The mathematical analysis is also included in the data table. • The mathematical analysis is calculated accurately (with one decimal place past the level of accuracy of the measurement tool	Comments:				
Scientific Method Skill: Make detailed <u>observations</u>	E	M	A	FFB	Revise
• Some extra observations are included. • Most of the extra observations are detailed. • Some of the observations are *significant*. • Some potential sources for error are described in the observations. • The observations are all scientific observations (precise, no slang or opinion words). • The observations are not inferences. • The observations do not just restate what is in the data table. • The observations are written in complete sentences.	Comments:				

Scientific Method Skill: Represent data using proper graphing techniques	E	M	A	FFB	Revise
• The graph is neat, hand-drawn and easy to read. • The data is graphed accurately. • The type of graph is appropriate for the type of data measured. • The graph (and legend, if appropriate) has a descriptive title that summarizes the information graphed. It will usually include the independent and dependent variables. • The independent and dependent variables are labeled on the correct axes of the graph. • The labels and units for the axes of the graph are accurate and detailed. • The scale for the graph is constant. • The choice of scale used for the graph most appropriately represents the data.	Comments:				
Scientific Method Skill: Make appropriate conclusions from data	E	M	A	FFB	Revise
• The conclusion restates the problem for the experiment. • The conclusion summarizes or restates the hypothesis. • The conclusion describes whether the hypotheses was supported or rejected. • The conclusion uses the appropriate mathematical evidence for support (not just mean). • The mathematical evidence selected also includes a description of why that type of evidence was selected as support • The conclusion paragraph(s) include topic sentence(s), supporting sentence(s), and transitions.	Comments:				
Scientific Method Skill: Make an appropriate inference	E	M	A	FFB	Revise
• The inference gives at least one example from the background information (not from an experimental error) that supports or refutes the results from the experiment. • Based the results, the inference uses background information to explain the connection between the independent and dependent variables. • Based on the results, the inference also identifies the type of relationship that exists between the two variables (is it a positive relationship, negative relationship, or is there no relationship). • Several sources for error are described in the inference and these significantly affect the accuracy of the results. Poor lab technique is not the only source for error described in the inference. • The changes suggested for repeating the experiment correct the sources for error described in the inference. • The inference describes a logical problem for an experiment that would be performed next based on the results from this experiment. • The inference is written in paragraph format.	Comments:				
Scientific Method Skill: Make accurate metric measurements	E	M	A	FFB	Revise
• Only metric measurements are used in the lab report. • The measurement units are accurate for the type of measurement being made. The units are labeled next to each measurement.	Comments:				
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Do you think you will keep incorporating data visualization in the future?

Yes. Collected data is a group of random numbers until it is properly displayed.