One-day Lesson Plan Outline

*Lesson Title: Graphing with the Data Discovery Tool*

*Grade level = Middle School*

*Amount of time for this lesson = 45 minutes*

*Written by: Danielle Larson (B.A. in Marine Science)*

1. Standards and Safety and Materials:

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| A. Standards - (Both Wyoming and NGSS. Number and write it out) | **5-ESS2-1:** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact  **CCC:** A system can be described in terms of its components and their interactions. |
| B. Safety Concerns: If none – “minimal safety concerns with regular class activity” | This lesson should have minimal safety concerns. |
| C. Materials (List of all materials needed for class including **technology** – like probes, tools, computer use, etc…) | Computers/tablets, graphing paper, colored pencils, access to the UW microbe data discovery tool, copies of the data table on appendix 1, 4 pieces of graph paper per student, student notebooks, tape an scissors.  The graphs and data tables used in this lesson should be taped into a section of the student notebook for their use later in the semester. These can be graded as a summative assessment when the unit has been concluded. |

1. Objectives: (List them and make sure all are measurable! **Bold** the verbs. Three different levels!) Students will be able to…

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| A. SWBAT… | **Analyze** data points from the data discovery tool for three locations in Wyoming and the types of Microbes found there. |
| B. SWBAT… | **Interpret** data from three different locations from the data discovery tool. |
| C. SWBAT… | **Graph** data points from three locations on the same graph to compare locations in Wyoming. |

1. Connections, Misconceptions, and Crosscutting Concepts:

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| A. Real world connections: (List them; e.g. Careers, Societal issues, etc…) | All science careers have some aspect of data analysis in their field. Microbes are an area of great interest especially when it comes to microbes in the soil around Wyoming. These microbes are of interest in order to create a microbial community that can repair some of the damage seen in areas like the coal mines in Gillette. |
| B. Student connections: (List them; With what do they connect? Music, food, etc…) | Microbes are important in agriculture in order to produce a healthy field. This connects to rural students that have grown up on farms as well as all other students due to the fact that its important for food production. |
| C. Misconceptions: (List those AAAS misconceptions related to your content) |  |
| D. Crosscutting Concepts: (List them and explain how they are used – e.g. patterns, cause/effect, scale/proportion/quantity, systems/system models, energy/matter, structure/function, and/or stability/change) | This lesson can cover cause and effect relationships between what is considered a healthy community versus an unhealthy community. By extension this lesson can cover proportion because the students will be comparing three locations from the data discovery tool. |
| E. Academic Language: [List the words/prefixes/suffixes that are addressed (focus on science vocabulary as well as instructions such as analyze, compare/contrast, etc…). *What* will the teacher do? *How* does the teacher address the words/prefixes/suffixes? *How* does the teacher get students to use those words, prefixes, and/or suffixes?] | Vocabulary: microbe, temperature, soil samples, graphing, and interpretation.  These terms should not be unfamiliar to students because some previous courses should have discussed the concepts of graphing and temperature before. When it comes to microbes these should be introduced in a lesson prior to this one.  On the part of the teacher these vocabulary terms should have already been introduced prior to this lesson. |

1. Catch/*Engagement*: (Hook them quickly – use all 5 senses at different times – should be no longer than 5 minutes.)

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| Hook: How to get student/class attention | The hook for this lesson should be a demonstration of how to use the data discovery tool, show the students how to find the data they will be working with. Talk about how the samples are collected and represented in the discovery tool. |

1. Pre-test: (Same as post-test and short – to the point… **Bold** the objectives you are using – same as above!)

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| Pre-test and Post-test question(s) Put the pre-test at the end of this day’s lesson plan (along with PowerPoint etc…)! | What factors affect the soil microbial communities in Wyoming? Why should these be analyzed when taking soil samples? |

1. Activity/*Exploration*: (**Bold** the verbs that match the objectives. Can have as many parts as needed – step by step directions.)

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| 1. Beginning of lesson | Open the lesson with the hook (navigating the data discovery tool) and the pretest questions listed above. |
| 1. Middle of lesson | After the students have seen how to use the data discovery tool, allow them to work in groups of two to find three locations in Wyoming they would like to examine further. These locations should have data collected from the same day in order to make the graphs accurate. Once they have found three locations, have them record the data from each site in the table found on appendix 1 (at the end of this lesson). I have left a column empty in the first data table for any other data you would like your students to examine the differences at the locations used for graphing. The second data table the students will fill out is the temperature differences at the same location on five different months (found on appendix 1).  Both sets of data will be graphed individually. The first graph will show the temperature differences at the three locations where data was collected on the same day. The second graph will show the number of microbes identified at each location, represented by a bar graph. The third graph will be of the teachers choice in information on the database. The final graph will be a line graph showing how the temperature of the soil samples in five different months. |
| 1. End of lesson | The third part of this activity is having the students write paragraphs explaining the data they found. Two paragraphs should be written about the first three graphs. In the first paragraph the students should be able to explain the similarities of the three locations and their microbial communities. The second paragraph should discuss the differences of the three locations.  Another paragraph should be written about what they can interpret from the data collected at one location over an extended period of time. They should be able to use weather patterns from across the state to talk about the differences seen in those five months. |
| 1. Are lecture (<11 min), lab, etc… clearly explained? Are directions and student expectations explicit? *Did you do this? Yes or No* | This lesson itself doesn’t include a lecture portion. However, a lecture about microbes should be done prior to utilizing the data discovery tool. |
| 1. PowerPoints, lab sheets, notes, answer keys, etc… included? *Did you do this? Yes or No* | The only lab sheet for this lesson is included at the end. Appendix 1 contains two data tables that will be used for the students to fill in and this data will then be graphed for interpretation. If the teacher would rather provide students with a list of locations they can use for their data collection this would be on form of an answer key, however, I find most useful to give students a guideline for the information they are looking for to provide them with the option for this lesson. |

1. Review/Essential Questions/*Explanation*: (Should be closely related to pre/post-tests!)

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| A. Low Level Questions – (Knowledge/Remembering and/or Comprehension/Understanding) | 1. Analyze the data collected in this lesson for patterns.  2. Compare an additional three locations in different areas of the state to the three already used in this lesson, what are the similarities? |
| B. Middle Level Questions – (Application/Applying and/or Analysis/Analyzing) | 1. From the data collected, interpret what this means for the microbial communities in three different locations. |
| C. High Level Questions – (Synthesis/Evaluating and/or Evaluation/Creating) | 1. Design an ideal sample collection for this project by answering the questions: where would you go to collect soil samples, how would you collect the data required by this website, what tools would you need?  2. Explain the uses of the data collected by this tool for the whole state. |

1. Assessments (Post-test)/*Evaluation*: (**Bold** the verbs that match the objectives and are in the activity.)

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| A. Formative: (Check for learning in class?) e.g. Oral questions? | The first formative check should be done while circulating the room by checking for the data tables being filled in. An additional check should be done while students are creating their graphs and writing of their paragraphs. The pre and post-test questions should be written in their individual notebooks, the pre-test will be before the data tables that are taped in this section with their graphs. Following the graphs the students will write their responses to the post-test questions at the end of this section. |
| B. Post-test: ( “Same as pre-test”; Compare w/pre-test to inform teaching!) | What factors affect the soil microbial communities in Wyoming? Why should these be analyzed when taking soil samples? |
| C. Summative: (Check for final learning/understanding) – e.g. Students turn in **constructed** project and **take** 20 question multiple choice test. | This lesson itself does not include a summative assessment. However, the graphs and data tables in this lesson should be assessed at the conclusion of the unit in which this lesson is embedded. |
| D. Explain how the data informs tomorrow’s teaching. For example, “The class post-test average must be a 80% or the next class begins with a 10 minute review/discussion of today’s material followed by another post-test of the same material.” | Should the results of the pre and post-test questions show an average of under 75% then the concept of microbes should be reviewed at the beginning of the next days class. In addition to the exit ticket, there are three other formative checks that should be examined for understanding. This graphs in this lesson should be examined for accuracy and scaling. |

1. Timeline for your lesson:

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| Pre-Test | The students should fill out the pre-test questions in their notebook at the beginning of the class. This should take a total of 3 minutes. |
| Catch | The catch for this lesson is a demonstration to the use of the data discovery tool. This catch can take anywhere from 5-10 minutes to show all of the aspects of this database. |
| Activity | Since the majority of this lesson is completed in groups the collection, graphing and interpreting of data should take approximately 29-34 minutes (this amount depends on the amount of time dedicated to the demonstration).  **Data Collection:** This portion of the activity should take the least amount of time. This will also depend on how in depth the demonstration was.  **Graphing:** Since some students struggle with scaling this portion of the activity may take a little longer to complete.  **Writing:** The remainder of the time should be spent on interpreting what this data means for the microbial community. |
| Review and Post-test | Since the groups will work with different sets of data the review session should be a discussion with two groups about the data they collected and how it was interpreted.  An additional 3 minutes should be dedicated to the post-test questions. |

1. Enrichment/*Elaboration*: (Include one enrichment activity for students that might finish early)

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| What enrichment activities are offered for students in this lesson (beyond what is taught)? | For the students that complete this activity early, have them examine one location from each corner of the state. If they already have completed part of this, then have them look at random locations determined by you. |

1. IEP Accommodations/Differentiation/Diversity: What accommodations will you use to support struggling learners?

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| What accommodations are used to support struggling learners? | One accommodation that has already been accounted for in this lesson is that of group work. Another accommodation would be to have those students who don’t like group work, complete this activity on their own. If this lesson is the first time the students are graphing data, then doing so as a class would be another accommodation. |

Appendix 1

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| **Location** | **Date** | **Temperature** | **Number of Microbes Identified** |  |
| **1.** |  |  |  |  |
| **2.** |  |  |  |  |
| **3.** |  |  |  |  |

**Location:**

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| **Date (Five Different Months)** | **Temperature** |
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