EPSCOR Data Collection

Lesson Plan Outline

*Lesson Title: \_Out in the Field: Data Collection, Classification, and Input\_\_\_\_*

*Grade level = \_*Middle or High*\_\_ Amount of time for this lesson = \_\_\_50+\_\_\_ minutes*

1. Standards and Safety and Materials:

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| A. Standards - (Both Wyoming and NGSS. Number and write it out) | MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.  MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function. (LS1.A: Structure and Function)  Science and Engineering Practices: Developing and using models, planning and carrying out investigations, obtaining, evaluating, and communicating information. |
| B. Safety Concerns: If none – “minimal safety concerns with regular class activity” | Safety goggles will be used as a precaution- safety gloves and lab coats will be made available. These dyes will dye anything and everything so though they are not dangerous encourage students to wear their cruddy clothes and use the gloves and lab coat. |
| C. Materials (List of all materials needed for class including **technology** – like probes, tools, computer use, etc…) | Safety goggles, Lab coats, Gloves  Q-tips, Petri dishes with agar  Glass slides, inoculation needle, coverslip, Microscope, DI water  Iodine, Crystal Violet, Rubbing Alcohol (Isopropyl or Ethanol), Safranin, bibulous paper, Bunsen burner  Glue, styrofoam, foam, pipe cleaners, beads, push pins, pom poms, cardboard, and string  Laptops, tablets, or cell phone use for research |

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… ***use*** *a measurable verb* | **Investigate** a microbe from their surroundings using a Gram stain |
| B. SWBAT… | **Create** a prospective plan for data field collection or **research** antibiotic mechanism |
| C. SWBAT… | **Use** the data discovery tool to **propose** a method of data collection, and basic taxonomic classification |

1. Connections, Misconceptions, and Crosscutting Concepts:

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| A. Real world connections: (List them; e.g. Careers, Societal issues, etc…) | Think like a scientist: create a real-world method of investigation, organism classification, use a microscope- this is data collection out in the field and data entry!  Also, when students think of bacteria, they probably think of pathogenic bacteria. The cell wall especially matters when we think of targeting pathogenic bacteria with antibiotics, which is one of the subjects they can delve into deeper through the follow up research. |
| B. Student connections: (List them; With what do they connect? Music, food, etc…) | Ask students for examples of where microorganisms are- then give some additional examples: microorganisms are responsible for fermentation, so kombucha, fermented soy in soy sauce- and, closer to home, they will see after incubation- their skin, their tongue, their phone- microbes are everywhere! |
| C. Misconceptions: (List those AAAS misconceptions related to your content) | CEM001: All cells are the same size and shape, i.e., there is a generic cell.  CEM005: There are no single-celled organisms. |
| 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) | Structure and Function: Investigation into cellular membranes for prokaryotic cells and how they differ, and colony shape and size and how it can be categorized, as well as cell clustering and shape.  Interdependence of Science, Engineering, and Technology: Use of the EPSCOR data discovery tool will help to show how data can be categorized and compiled for further use. Students will make observations about relevant information for processing using the data discovery tool as a guide. They will also use it to create a game plan for data collection out in the field (in the home state of Wyoming!)  NOS:  Science is a Human Endeavor: Openness to new ideas- microbiology requires openness as we are still learning so much and it is a vast world to delve into.  Scientific Knowledge is Based on Empirical Evidence: This investigation into the world of microbes requires evidence- using data collection to improve our understanding. |
| 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?] | Prokaryotic or Bacterial cell (this should be review)  Gram (–) or (+) cellular membrane: lipoteichoic acid, teichoic acid, peptidoglycan, cytoplasmic membrane (lipid bilayer) and lipopolysaccharides, porin proteins, lipoproteins, periplasmic space. Students will investigate these terms on their own, with guidance or clarification as needed.  Inoculation: Students will be guided through this process.  Other vocabulary students will research and illustrate:  Bacilli, Cocci, Strepto-, Diplo-, Tetrad, Sarcina, Staphylo-, punctiform, undulate, rhizoid, lobate, filamentous, pulvinate, umbonate. |

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 | Petri dishes sitting at each student’s desk. |

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…)! | How is data collected for microbes? What are some ideas for organizing data entry? |

1. Activity/*Exploration*: (**Bold** the verbs that match the objectives. Can have as many parts as needed – step by step directions.  
    *(Remember: Include at least 1 science writing activity and probe activity for the unit!)*

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| 1. Beginning of lesson | The day previously, students will have swabbed an area of interest to them: their ear, the bottom of their shoe, their mouth, their armpit, their phone, the countertop- and inoculate a petri dish. This will be set aside to incubate so that they can see the growth, and use the colonies to create the gram stain today.  Students will start the period by collecting their petri dishes, and doing independent lab observations. In their lab notebook or the accompanying worksheet, students will record the number of different colonies, their size, shape, and color, and how many colonies of each type. |
| 1. Middle of lesson | An introduction will be made to the EPSCOR data discovery tool. Students will be able to look at the tool and explore by region. Once students have had five minutes (give or take) to explore the website and familiarize themselves with the layout, they will start to investigate and create a list of all the necessary data needed for entering an organism into the database. This will be recorded in the lab notebook.  They will then begin the process of looking at their samples under a microscope, both to make observations about their sample, and to familiarize with the microscope (students will need guidance for microscope use.) Students will break off into groups of three or four depending on microscope availability. They will be encouraged to identify how the organisms form into groups and their basic shape- cocci, bacilli, etc, following the lab handout. (If microscopes are not available, an alternative option for this lesson plan may be skipping to the portion of the lesson where students create a model of a Gram (+) or Gram (-) cell membrane. In towns with a community college, classes may look at the feasibility of a short field trip to the community college lab to borrow (supervised) lab equipment in order to investigate their organism.) It might work best, if there are resources available but they are limited, to use these different options as rotating stations (models, research, or microscope use).  Once they have explored their organism, they can start with the most basic classification technique- a gram stain. They will be guided through this in the lab packet, but a demonstration is encouraged. |
| 1. End of lesson | Finally, students will be given an option to investigate an antibiotic mechanism (what in the cell the antibiotic targets) or create a proposal for field collection, detailing what would have to be collected and how. |
| 1. Are lecture (<11 min), lab, etc… clearly explained? Are directions and student expectations explicit? *Did you do this? Yes or No* |  |
| 1. PowerPoints, lab sheets, notes, answer keys, etc… included? *Did you do this? Yes or No* |  |

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) | What is the difference between a Gram (-) or a Gram (+) cellular membrane?  Where can microbes be found? |
| B. Middle Level Questions – (Application/Applying and/or Analysis/Analyzing) | Why does cellular membrane structure matter for antibiotics?  How can data samples of microorganisms be collected? |
| C. High Level Questions – (Synthesis/Evaluating and/or Evaluation/Creating) | How would you go about classifying an organism?  How could the data in the EPSCOR data discovery tool be used? |

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? | Lab work sheets/Lab notebook  Data collection Proposition  Cell membrane models  Pictures of Microscope or turn in the slides |
| B. Post-test: ( “Same as pre-test”; Compare w/pre-test to inform teaching!) | How is data collected for microbes? What are some ideas for organizing data entry? |
| C. Summative: (Check for final learning/understanding) – e.g. Students turn in **constructed** project and **take** 20 question multiple choice test. | There will be no summative assessment for this lesson plan. |
| 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.” | Since this lesson plan will take more than one class period, check on lab notebooks/worksheets will allow for a check in understanding. This way, concepts can be review during the following class period. Students will be encouraged to use their lab partners to collaborate and to help understand concepts. |

1. Timeline for your lesson:

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| A. Catch 2 min  B. Pre-test 3 min  C. Activity – 4 parts 40 min  D. Review and Post-test 8 min  Add/change as needed | This lesson plan is flexible and can take be shortened or lengthened depending on points of interest. Since there are multiple activities included, they can be excluded from the lesson at the teachers’ discretion due to time or resource limitations. |

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)? | If students do have additional time, they might go further into the taxonomic research for organism classification, and how that is approached, or they may research the mechanisms of antibiotics- and create a short 3-5 FlipGrid or vlog post, or a two-paragraph blog post to report their findings. |

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? | Group work/collaboration will be used as a tool, as well as hands on activities and models. For classrooms that participate in one, vocabulary can be added to the word wall. |