Teaching Science as Inquiry (TSI) Lesson Plan #3
Module 3: Biological Aquatic Science

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Activity: Microevolution

1. Why did you choose to do this activity?

My students often exhibit weak skills in math and this activity is a great one to review probability and to practice graphing a population over time.

2. What are your classroom learning goals?

I would like my students to be able to collect and analyze data mathematically easily and with confidence. Given a set of data, they should be able to represent it graphically.

3. How does this activity tie into your classroom learning goals?

In this activity, the students will be modeling the population of bacteria using a simple measure, the rolling of a die. They will quickly gather a set of data and analyze it by graphing the two different bacterial populations. As a class they will compare the growth curves and be able to visualize the patterns amongst a number of data sets of the same procedure.

4. What date do you plan to start this activity? March 20, 2013

5. *If applicable:* HIDOE standards this lesson will address

- **Benchmark SC.MS.1.2** Design and safely implement an experiment, including the appropriate use of tools and techniques to organize, analyze, and validate data

Ocean

6. Describe how you will connect this activity to the ocean:

In the activity, the students are told they are modeling microevolution of species of a microorganism, a bacteria. As we begin our unit on Biological Marine Science, this will introduce the idea of populations, which is important in showing the relationship between organisms. In the ocean, there are many diverse organisms including

bacteria. A change in the population of one organism can cause a shift in another if they are closely linked by their interaction.

7. Select the Ocean Literacy Principle(s) that you anticipate this activity will address. (check all that apply)

☐ 1. The Earth has one big ocean with many features.
☐ 2. The ocean and life in the ocean shape the features of the Earth.
☐ 3. The ocean is a major influence on weather and climate.
X 4. The ocean makes earth habitable
X 5. The ocean supports a great diversity of life and ecosystems.
☐ 6. The ocean and humans are inextricably interconnected
X 7. The ocean is largely unexplored

Preparation

8. How will you prepare your students for this activity? (For example, review of prior knowledge.)

I will not prepare my students ahead of time for this activity but will assess their prior knowledge of bacteria and antibiotics during initiation.

9. Explain any instructional struggles that you foresee and how you will address these issues. (For example, student misconceptions, classroom discussion, aspects most difficult for students to grasp, etc.)

I think it may be difficult at first for the students to remember that the typical bacteria are those that are non-coated paperclips, as the coating may seem to be a mutation that affords a fancier appearance. The graphs may also pose a challenge, as the data is showing a change in population over time rather than total numbers of bacteria.

10. What ***TSI inquiry*** *questioning strategies* will you use to help your students meet your learning goals?

• **Clarifying** – to prompt Ss to be more specific
• **Extending** – to help Ss see connections between the data and trends
• **Focusing** – to keep Ss on track during the discussion and presentations
• **Withholding judgment** – to encourage Ss to share their ideas and remind them that we need to be accepting and open-minded to others' ideas

Use the following table to plan your lesson using TSI.

For each phase:

- **Teacher:** Describe what you will be doing
- **Student:** Describe what your students will be doing
- **Assess:** Describe how you will assess your students in this phase so you can monitor their progress through the activity

INTERPRETATION		INITIATION	
Teacher	• Part 4: Assist students as needed by asking clarifying, extending, and focusing questions	Teacher	• Part 1: Ask students if they have ever been prescribed an antibiotic.
Student	• Part 4: Look at graphs and answer questions on worksheet	Student	• Part 1: Share the names of antibiotics that they know.
Assess	• Part 4: Activity Questions	Assess	• Part 1: Check that students take notes on and understand bacterial replication and antibiotics.
INSTRUCTION			
Teacher	• Part 1: Tell students we are looking at whether the bacteria will survive based on if they are resistant or sensitive to an antibiotic. Explain terms “sensitive” and “resistant.” • Parts 2-4: Check for understanding at various points throughout the activity.		
Student	• Part 1: Read background material aloud. • Parts 2 & 3: Communication during activity pair work. • Part 4: Answer questions from peers and teacher and discuss ideas		
Assess	• Part 1: Check for understanding and usage of new terms: resistance, exposure, typical, mutated. • Parts 2-4: Check that students are discussing the activity with their partners and other classmates.		
INVESTIGATION		**INVENTION**	
Teacher	• Part 3: Monitor students as they roll die and collect data and assist as needed.	Teacher	• Part 2: Explain procedures (demo).
Student	• Part 3: Students carry out the procedures to collect data on survival or death of bacteria (paperclips).	Student	• Part 2: Read and follow along with demo and manipulate materials to practice.
Assess	• Part 3: Check that students are assigning the correct fate to the bacteria using the roll of the die.	Assess	• Part 2: Check that students are clear on procedures.

11. Briefly describe how you will guide your students through the TSI Phases of Inquiry. (You are the research director of your classroom, and thus guide or facilitate the learning in your classroom, even if an activity is very student-directed).

During initiation the topic of microevolution will be introduced in reference to a population of bacteria that is encountering selective pressure from the presence of an antibiotic. Students will practice invention by following a model of the system introduced by the teacher, rolling of a die to determine the fate of individual members of a population. Their investigation will be carried out as they apply this method in pairs to gather data. Students will make interpretations about the data collected by the class as a whole. Instruction will occur throughout the activity as the teacher presents authoritative knowledge and explains procedures; the students and teacher ask and answer questions during group and class discussions.

12. What *overarching* TSI mode(s) will you focus on for this activity? Why?
Modes: Curiosity, Description, Authoritative knowledge, Experimentation, Product evaluation, Technology, Replication, Induction, Deduction, Transitive knowledge

The TSI modes that will be focused on will be replication and authoritative knowledge. Student pairs will replicate the same experiment by contributing a set of data to the class as a whole. Authoritative knowledge is needed at first to introduce the students to the process of bacterial replication and antibiotic resistance and sensitivity. Induction may also be practiced as the students begin to see patterns in the data.

Please provide any additional comments that will help you prepare to teach this activity or help the TSI facilitators understand how you plan to teach this activity.

I will be teaching this activity for the first time and rather in an isolated way from the main sequence of lessons, so I hope that I will be able to connect it to the rest of the material that we are covering without too much stretching.