**Teaching Science as Inquiry (TSI) Lesson Plan**

**Module 3: Biological Aquatic Science**

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Activity: Modeling Microevolution

1. Why did you choose to do this activity?

I chose to do this activity because although the activity did not fit into the curriculum, it seemed like an activity that my students would enjoy.

2. What are your classroom learning goals?

 I will be able to:

* Show how Sun angle affects Earth’s temperature.
* Describe how Sun angle changes due to:
	+ - Earth’s axial tilt
		- Earth’s revolution

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

 This activity did not tie into my classroom learning goals.

4. What date do you plan to start this activity?

 January 28th

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

**Ocean**

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

In introducing the activity, I will give students some background information about bacteria using the example of thermophiles living at the bottom of the ocean as bacteria that can survive at very extreme environmental conditions.

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.

□ 4. The ocean makes earth habitable

□ 5. The ocean supports a great diversity of life and ecosystems.

□ 6. The ocean and humans are inextricably interconnected

□ 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 prepare students for this activity by providing some background information about bacteria. This will include information about where they live, how they reproduce, their interactions with humans (positive, negative, and neutral), some of the common diseases caused by bacteria, how such diseases are treated, and how antibiotics target and destroy pathogens.

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 foresee students struggling to keep track of what different numbers rolled meant as they transition back and forth between “typical” and “mutant” bacteria and the different odds of survival associated with each. To address this issue, I plan to present the odds and the reasoning behind them at the beginning. Before students roll for the “typical” bacteria, we will discuss what each roll means. Then, after rolling, they will pause and wait for all groups to finish (discussing what happened and why) before we discuss the differences in odds and what different rolls mean before students switch over to rolling for the mutant bacteria. I plan on doing this for generation 1, but “setting students loose” in generations 2-5.

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

One questioning strategy I plan to use is the “lifting question”. I plan to do so while students are engaged in the “rolling” portion of the activity while I am circulating the room. I plan to approach each group and beginning questioning by asking them if they think that they would get the same exact results if they performed the experiment (rolling for generations 1-5) a second time. I will ask the group if anything about their rolling was out of the ordinary or surprised them based on their prediction. I will ask them what the chance is that they would roll that sequence of numbers again…were those rolls “favored” or were they an anomaly? By these lifting questions, I want students to start thinking about the application of these concepts to a larger population.

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| 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
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| **INTERPRETATION** | **INITIATION** |
| Teacher | Will give instructions for students to discuss what happened in the activity and compare it to their hypothesis and analyze what happened. | Teacher | Presenting information that ties bacteria to both the ocean and students’ daily lives. |
| Student | Will discuss with group and record answers in the designated area. | Student | Silently listening with eyes on the teacher and hands raised silently to ask questions. |
| Assess  | Are all students engaged in the discussion? Are all students writing in the designated space? | Assess  | Are students silent with their eyes on me? This will tell me: Are they listening?  |
| **INSTRUCTION** |
| Teacher | Will be giving a lesson on bacteria, explaining the activity, or reviewing instructions for what students will be doing based on various rolls. |
| Student | Silently listening with eyes on the teacher and hands raised silently to ask questions. |
| Assess  | Are students silent with their eyes on me? This will tell me: Are they listening?  |
| **INVESTIGATION** | **INVENTION** |
| Teacher | Circulating the classroom checking in with each group to first make sure they are conducting the activity correctly and then circling back through groups to exercise lifting question strategies. | Teacher | Gives instructions for hypothesis generation and then circulates the room to make sure all groups are generating a feasible hypothesis. |
| Student | Rolling, counting paperclips, filling in table, etc. | Student | Working in a group setting to create a hypothesis for what will happen in the activity. |
| Assess | Are ALL students actively engaged in the activity? Can ALL students contribute when their group is asked probing questions about what is happening and why it matters? | Assess | Are all students engaged in the discussion to create a hypothesis? Are all students writing the hypothesis down in the designated space? |

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).

Instruction and Initiation – I will provide students with some background information about bacteria in the form of a “mini lesson”. Part of this will be explanation of the activity we are about to conduct as well as why certain bacteria could/will be favored in certain situations and how we will simulate this preference in the activity. Another part of this will be initiation in the form of showing how bacteria applies to both the ocean and our daily lives.

Invention – Students will transition to their table groups and work together to generate a hypothesis about what will happen in the activity, being specific as to how many “typical” and “mutant” bacteria they think they will have at the conclusion of generation 5.

Instruction – A quick review about what different rolls mean and the procedures for the activity.

Investigation – Students conduct the activity.

Interpretation – Students answer some reflection questions about whether their hypothesis was near to what happened and why or why not.

Invention – In part 2 of the lesson, a different scenario is given in which environmental pressures will shift, but then shift back. Students will apply what they know from the previous activity to this new situation and make a prediction.

Investigation – Students conduct the activity.

Interpretation – Both during the activity and afterward we have discussions about what is taking place compared to the hypothesis, how things might change had rolls or environmental pressure gone a different way, and how the scenario could apply to real life.

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

Authoritative knowledge – for background information on bacteria

Replication – because every time the activity is done, the numbers will likely change

Transitive knowledge – students will be applying and using their transitive math knowledge of statistics

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.