**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 I felt that it enriched my unit on Plate Tectonics, and helped address the question: What Happened to the Dinosaurs?

2. What are your classroom learning goals?

My classroom learning goal is to have my students apply the concepts of microevolution to evidence for plat tectonics. I also want my students to exhibit the scientific demeanor of 'open mindedness' and 'critical thinking'.

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

This activity simulates microevolution in a strain of bacteria, but the learning can be extended to larger organisms.

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

1/28/2012

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

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| Benchmark [SC.8.5.1](http://165.248.30.40/hcpsv3/imr/report_by_code.jsp?code=SC.8.5.1) | Describe how changes in the physical environment affect the survival of organisms |

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| Benchmark [SC.8.8.5](http://165.248.30.40/hcpsv3/imr/report_by_code.jsp?code=SC.8.8.5) | Explain the concepts of continental drift and plate tectonics |

**Ocean**

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

One of the evidences for continental drift and plate tectonics is fossils of organism. Land animals are used as evidence that the continents were together at one point (since land animals can't swim across an ocean). Aquatic fossils are used to show that the Earth is dynamic and has changed shape over many many years (fossils of sea shells and sharks in Kansas, or on the top of mountains, etc). Both of these evidences imply that the Earth's surface is constantly evolving. Also, we will discuss how similar living organisms on different continents can be used as evidence that the continents used to be together, and also why they have differences.

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

x 1. The Earth has one big ocean with many features.

x 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.)

This lesson will be the third in a sequence of lessons that stress scientific demeanor, the phases and modes, and the language of science. First, we will review phases, modes, and demeanor so that students are thinking and acting like scientists and have more of an open mind about content and different points of view. Then, we will learn about scientific language (theory and law) and how strong a theory actually is as a working explanation for natural phenomena. Finally, we will use this knowledge to examine a controversial but important theory: microevolution and apply that theory in discussion to a final theory: Plate Tectonics.

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'm leery about discussing evolution in my class. I have a few students are vehemently opposed to the idea, so I'm not sure how they'll react. Also, I know students **still** think that humans evolved from monkeys, and I will need to correct that misconception as well.

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

I'm going to use extending, clarifying, and lifting questions during the activity and the open-discussion we have at the end of the activity. Before the bell rings, I will use summarizing questions to help students bring meaning and organization to what they've learned in the activity and through discussion.

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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 | Ask students to answer questions at end of packet, also, in discussion, apply activity to dinosaurs and extinct species.  | Teacher | Ask question: “What happened to all the dinosaurs”. Follow responses with further questions guiding towards concept of “change over time.” Lead into activity “would you like try to simulate what happened?” |
| Student | Apply microevolution in bacteria to populations of organisms that survived 'whatever killed the dinosaurs'. Answer questions at end of packet | Student | Students will answer questions (one will probably mention the meteor impact).  |
| Assess  | Questions in packetDiscussion  | Assess  | Students asking and answering questions, participating in discussion. |
| **INSTRUCTION** |
| Teacher | 1) set up scenario for microevolution. Say, that we're going to simulate the dinosaurs using bacteria in a thing called microevolution. Give brief lecture about what microevolution is. Then say we're going to apply it to dinosaurs afterward. 2) (this also ties into interpretation)--summarize experience in group-discussion. Have students graph data. |
| Student | 1) take notes on brief lecture.2) students take notes and participate in class discussion. Graph data.  |
| Assess  | 1) Completed notes.2) discussion questions and graphs |
| **INVESTIGATION** | **INVENTION** |
| Teacher | Wander room and answer questions. Help students do math for first generation (if needed). Mention results from other groups. Ask students to begin interpreting what they think their data means/what it would represent in the wild | Teacher | Help students make predictions.  |
| Student | Do activity and record data. Pause briefly to discuss as a class what happened after the first generation. | Student | Make predictions about the bacterai strains.  |
| Assess | Completed data table, appropriate answers to spot-questiosn. | Assess | Students will have predicted.  |

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).

I plan to use questions to guide between the phases. Initiation: “what happened to the dinosaurs?” Instruction: “Would you like to simulate that experience?” Initiation: “What do you predict will happen?” Investigation “What's happening?” Instruction: “What happened? What is this process called?” Interpretation: “Why did this happen? How does this connect with our original question? Why did other people get different results, but MOST of you got the same result?”

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

Replication: it's important for students to be able to understand that (micro)evolution is small changes within a specific population. It won't happen all at once, and it won't happen with ALL groups, this is why a dog isn't giving birth to something completely different with every litter. There's a hefty dose of randomness. And, the only way to see that randomness, is to do multiple trials.

Induction and Deduction: I'm asking kids to draw on their prior knowledge to make a prediction about the outcome of the activity, and then apply that outcome to a different situation.

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 really liked this activity. I think that using it as a follow-up to lessons on demeanors, phases and modes, and scientific language, really makes this lesson approachable for everyone.