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

**Module 3: Biological Aquatic Science**

Name: *Bryan Silver*

Activity: *Modeling Microevolution*

1. Why did you choose to do this activity?

I think this is a great lesson to start off students think how natural selection and evolution effect the organisms on our planet and how they came to be.

2. What are your classroom learning goals?

 I want my students to understand the workings of natural selection. And get an opportunity to model a probability of evolution scenario that they can use to understand in concrete terms.

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

 Biology and ecology, including natural selection, are part of my Biology course.

4. What date do you plan to start this activity? *March 1, 2013.*

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

**Ocean**

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

Given enough time, and populations that include sufficient genetic diversity,

those populations may be able to change to better survive in their environment.

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

X 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.)

My intention is to run the activity as a game, pretty much as written; and then together with the activity questions, add in the basics of natural selection, remind them of previous discussions we’ve had about artificial selection, and refer to the trends we saw during the activity during our discussion. Using the data collected in the graph to illustrate the phenomena.

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.)

The activity itself may take a few minutes to get rolling, and I usually have to deal

with a bit of confusion about how and where to add the data/results to the tables

provided. Will need to also address how to plot a graph.

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

Any and all as needed: clarifying, extending, focusing, lifting and summarizing.

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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 | Pose discussion questions following the activity.  | Teacher | Introduce the activity as a game.  |
| Student | Answer discussion questions. Authority Knowledge | Student | Collect pieces and make predictionsProduct eval |
| Assess  | Participation in discussion.  | Assess  | Signs of enthusiasm.  |
| **INSTRUCTION** |
| Teacher | Explain rules of the activity. Explain basics of natural selection.  |
| Student | Ask and answer questions .  |
| Assess  |  |
| **INVESTIGATION** | **INVENTION** |
| Teacher | Supervise data collection.  | Teacher | Encourage students to pose questions during the discussion(s) following the activity.  |
| Student | Perform tasks to collect data for discussion | Student | If there are any “What if…” questions I may ask if the student could propose a modification of the activity that might test their question.  |
| Assess | Successful completion of data collection.  | Assess | Questions on death and survival rates |

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’ll initiate the activity, introducing it as a game. The presence of dice will grab their attention, I just need to them focused on the activity and just rolling. Getting the kids to make a prediction before rolling is the next step.

They will need some coaching on my part as they start and run their investigation, collecting and calculating mortality and reproduction data for analysis.

I’ll have to take the stage for a while as the “expert” as we address the activity questions and attempt to interpret how observed trends explain how natural selection works.

I have a few students who will probably ask “What if…” questions along the way, and hopefully they will be something that we can turn into a test and try in the time we have.

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. In each data set collect from each group conducting the activity to observe trends. Technology in the use of probability cubes to determine survival rates.

Transitive Knowledge about super bacteria from non-completion of anti-bioatics.

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.

Activity Questions: Micro-Evolution

* Compare your final typical and mutant bacteria numbers with your class. How are your findings similar or different?  Why?
* Did your prediction match your observations? Why or why not?
* On average, how do the proportions of typical and mutated bacteria change in the population over time?
* What would have happened if you only had one mutated bacterium and it happened to die during the first generation?
* What do you think might happen to a population of bacteria that is exposed frequently to antibiotics, such as if a person was prescribed antibiotics multiple times a year?
* What was necessary to simulate microevolution? (Hint: Think about how the game would work if all the paperclip bacteria looked the same.)
* Explain why genetic evolution happens to a whole population rather than to a single individual.
* This activity simulated a selective process resulting in microevolution. How is microevolution related to or different than macroevolution?
* Before the widespread use of antibiotics, there were only low levels of antibacterial resistance. As antibiotic use has grown, so has the number of antibiotic resistant bacteria. Why do you think this has occurred?
* During a bacterial infection, exposure to antibiotics helps kill off bacteria. However, the antibiotic must be administered for a relatively long period of time. What might happen if someone were to be prescribed antibiotics, but did not complete their full course?
* If you did Procedure 10, optional part B, how did the first five generations of the model compare to the second five generations of the model?