Teaching Science as Inquiry (TSI) Lesson Plan #2
Module 3: Biological Aquatic Science

Name: Jennifer Seki

Activity: Scientific Language – Opinion, Hypothesis, Theory

1. Why did you choose to do this activity?

Using scientific language and terminology is important when we aim to practice science authentically. Students should use the correct terms for whenever possible and should realize that words are often misused in everyday conversation.

2. What are your classroom learning goals?

In the science classroom, I would like my students to be practicing authentic science, which means doing what scientists do on a daily basis, including speaking like scientists, using tools and equipment that scientists use, and engaging in a scientific community through sharing of data and results.

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

If students are to be practicing science authentically, they should be using scientific language when they plan and carry out laboratory investigations, ask questions, and discuss scientific topics. Earlier this year, students drew and discussed what a scientist looks like, what they care about, and what they do. In doing so, they realized that they too are scientists, because they have thoughts, perform actions, and communicate while doing activities in class, just as scientists do in their work.

4. What date do you plan to start this activity? February 26. 2013

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

- **SC.MS.1.1** Describe how a testable hypothesis may need to be revised to guide a scientific investigation
- **SC.MS.1.3** Defend and support conclusions, explanations, and arguments based on logic, scientific knowledge, and evidence from data
- **SC.MS.1.4** Determine the connection(s) among hypotheses, scientific evidence, and conclusions
- **SC.MS.1.9** Explain how scientific explanations must meet a set of established criteria to be considered valid

Ocean

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

This activity will be connected to the ocean through some of the statements that are presented to students to categorize as opinions, hypotheses, or theories. This will provide a review of such topics as plate tectonics, atomic theory, and density, and a preview of some of the biological oceanography material including marine invertebrates, and the activity "What is alive?"

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.
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
☐ 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 remind students of the "What is a Scientist?" activity that we did earlier this year and that although at first many students drew stereotypical scientists and said that they themselves are not scientists, we have learned since then that we practice science in our activities and labs using the thought processes, actions, and communication (phases and modes) that scientists do, so we are scientists too. The introduction to this activity will express the importance of using scientific language correctly while practicing science.

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 expect the students will have difficulty with the differences between opinion, hypothesis, and theory but that with enough practice and exposure to examples, they will be able to recognize and explain why a statement is or is not an opinion, hypothesis, or theory. This class also tends to be very talkative and sometimes impolite during discussions so I hope to be able to use questioning strategies to keep them on track and respectful of each other.

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, especially when defining controls and variables for hypotheses
- **Extending** – to help Ss see connections between the example statements and marine science material (atoms, density)
- **Focusing** – to keep Ss on track during the discussion and presentations and remind them to take notes
- **Lifting** – to expand from specific hypotheses to the process of research science in general
- **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	• Parts 1-5: Ask clarifying, extending, focusing, lifting questions during discussion	Teacher	• Part 1. PPT presentation – stereotypes about scientists, scientific Qs, scientific vs. day-to-day usage of scientific words
Student	• Part 5: Present/share ideas with class about assigned statement • Part 5: Ask questions/make comments to other groups	Student	• Part 1: Take notes on PPT about stereotypes about scientists/sci. lang. in SNB • Part 2: Write definitions for opinion (O), hypothesis (H), theory (T)
Assess	• Part 5: Students ask and answer questions • Part 6: Activity Questions (Finish for HW)	Assess	• Part 2: Assess prior knowledge of terms • Notes (SNB) • *Transitive knowledge
INSTRUCTION			
Teacher	• Part 2. PPT presentation – opinion, hypothesis, theory explanations (Authoritative knowledge)		
Student	• Part 2. Take notes on PPT in SNB. • Determine how O, H, and T are being misused in examples. • Part 3. Discuss statements in groups and determine if they are O, H, T.		
Assess	• Part 2. Pre-assessment of prior knowledge – Define opinion, hypothesis, theory in SNB • *Authoritative knowledge, transitive knowledge		
INVESTIGATION		**INVENTION**	
Teacher	• Part 3. Ask Ss why they classified statements the way they did • Prompt Ss to expand definitions	Teacher	• Assist Ss to clarify definitions using questioning strategies
Student	• Part 3. Look at statements and use criteria to determine which are Os, Hs, and Ts	Student	• Part 3: Modify/improve definitions of terms • Part 4: Rewrite O as hypotheses, controls & variables for H, and evidence for T
Assess	• Ss use definitions to categorize statements • *Induction & Auth. Knowledge	Assess	• Part 3. Check Ss understanding of O, H, and T • Completion of Table 1.2

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 scientific language will be introduced with examples in reference to the fact that we are practicing science as scientists do and should therefore use scientific terms correctly. Students will invent their own strategies for determining whether a statement is an opinion, hypothesis, or theory using the criteria provided. Their investigation will be carried out as they apply their method or strategy to different statements about science. This cycle will repeat as they classify statements, state the reasons for their classification, and make interpretations about the statements by analyzing hypotheses and theories and modifying opinions. 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; and when each group of students presents their statement and their analysis of it to their classmates.

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 overarching mode for this activity will be Authoritative Knowledge as the students try to use the common words correctly for science to identify opinions, hypotheses, and theories. Additional modes will be transitive knowledge and induction as students start to recognize what makes statements the different types.

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 adding one more statement that is a hypothesis in order to have each student group of four focus on a different statement. If there is time, I will also have students create their own opinions, hypotheses, and theories for extra practice.