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

**Module 2: Chemical Aquatic Science**

Name: *Anne McKnight*

Activity: *Modes of Inquiry*

1. Why did you choose to do this activity?

 *I’ve decided to do this lesson as the first activity of Mod 3 because it is a required TSI activity and because we are currently doing the rock cycle and I think the tie in to fossil remains of fish in sedimentary rock is my best chance to make fish anatomy relevant in an Earth Space Science class. Another reason is that the rock cycle can be a little boring…adding a fun, hands on lab seems like the perfect remedy!*

2. What are your classroom learning goals?

 *I would like the students to identify what structure and function various parts of fish anatomy have and recognize which parts of a fish’s internal and external anatomy are more likely to be preserved in the fossil record and also why. Additionally we will be looking at how this can happen in sedimentary rocks + why it is unlikely you will find fossilized parts in igneous or metamorphic rocks.*

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

 *I recognize that fish anatomy is a stretch to tie in to my class’s learning goals and 8th grade standards, but the rock cycle seems promising.*

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

*Tuesday, January 29, 2013.*

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

*8.8.1 I can illustrate the rock cycle & explain how igneous, sedimentary & metamorphic rocks are formed*

*8.8.2 I can compare the characteristics of the three main types of rocks*

**Ocean**

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

*The initial discussion will focus how sedimentary rocks are formed through weathering and erosion followed by transport, deposition, burial, compaction, and then lithification. Water’s very important role in each step of the process will be discussed as well as how ancient lake and ocean floors are the sites where sedimentary rocks formed. We will look at rock samples of each type and look for fossil remains in each one. Finally we will discuss how fossils form and water’s role in this process.*

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.)

 *We will have been discussing igneous rocks and rocks from coral reefs previous to this activity. I will ask students to think about how and why fish fossils are one of the more common fossil types. The samples in my rock collection are small and show partial or broken bits of shell and fish parts. We will discuss why this might be. Students will be sent home with the fish anatomy assignment and instructions to draw and label external anatomy while focusing on which parts are most likely to have survived in the fossil record.*

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 my students will struggle a bit with the idea that the dry center of the US used to contain a shallow sea – pictures of capitol reef in Utah will help because of its classic reef shape. The names of the various fish parts will also be difficult for my students to pronounce and differentiate, but*

**Questioning and Assessment Strategies**

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

*I will ask students to generate their own procedure for the gyotaku painting process so I think I will be asking a lot of extending and focusing questions when I ask students to analyze their method between each print to focus them on for what parts they are satisfied with and what parts might need a change of strategies. I will also try to bring in lifting questions to ask students to think about how the gyotaku printing issues might be similar to/different from the sedimentation and fossilization process.*

11. What *assessment strategies* will you use to help your students meet your learning goals and monitor their progress?

 *I will ask the students to answer the TSI Activity Questions (most) plus some of my own that ask students to compare gyotaku and fossils in sedimentary stones as a homework assignment the day we do fish printing. The next day I will assess their understanding by having them discuss how they answered the questions. I will also show them on line images of fish fossils and ask them to assess their prints for detail and frequency of specific fish anatomy parts in the fossils and their prints for similarities and differences in the 2 types of fish records.*

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| Use the following table to plan your lesson using TSI. For each phase:* **Mode(s):** List the Mode(s) of Inquiry you will incorporate
* **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

\*Modes: Curiosity, Description, Authoritative knowledge, Experimentation, Product evaluation, Technology, Replication, Induction, Deduction, Transitive knowledge |

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| **INTERPRETATION** | **INITIATION** |
| Mode(s) | Deduction, induction, & transitive knowledge. | Mode(s) | Curiosity, Description, Authoritative Knowledge & Transitive Knowledge |
| Teacher | I will ask students to share their homework answers to the activity questions and create a full class combined response that relates and pulls together the textbook readings on sedimentary and reef rocks, the fossils article on the back of the worksheets, the students’ experiences with printing and 7th grade knowledge of coral reefs. We will create a concept web to answer the question “What are all the ways water affects the fossils you find in sedimentary rocks?” | Teacher | Present the PowerPoint slides on sedimentary rocks and rocks from reefs. During the presentations pass out rock samples for students to look at and hold. Ask the students to identify fossils in the limestone, sandstone and shale. Use questioning to get students curious about each item and to get student thinking about why the fossils are almost all aquatic species. Use questioning to dig back into 7th grade coral reef unit for previous knowledge. |
| Student | Students share & discuss observations with the class by sharing diagrams, hypotheses and answers on their posters.  | Student | Students will observe the rocks and describe the rocks, suggest answers + definitions/details from 7th grade.  |
| Assess (look for) | Involvement in the discussion and a growing understanding of the concepts in the lesson through appropriate use of key vocabulary and transitive connections to outside examples.  | Assess (look for) | I will look for intelligent observations, correlations, interpretations and also misconceptions about the rocks and the aquatic species.  |
| **INSTRUCTION** |
| Mode(s) | Description, Authoritative Knowledge, Product Evaluation |
| Teacher | During the presentation, stop students and question them as they go through observations and responses to each rock type. During crayon rubbing & labeling, use questioning strategies to spark discussions and encourage students to peer teach rubbing strategies and anatomy names they are starting to master. During printing & discussion asking students to evaluate their prints and probe for other ways to get more detail in their prints.  |
| Student | Observe and discuss the rocks and their fossilsPeer teach ideas they are starting to master to partners or other nearby classmates. |
| Assess (look for) | Student ideas and answers that show them making headway with rock cycle and fish anatomy concepts. Students peer teaching partners who are asking for clarification, etc. |
| **INVESTIGATION** | **INVENTION** |
| Mode(s) | Curiosity. Experimentation, Replication, Induction | Mode(s) | Description, Transitive Knowledge, Induction, Product Evaluation |
| Teacher | I will monitor and guide the students through the rock observations, crayon rubbings, and gyotaku fish printing asking and answering procedural and interpretation questions while they investigate | Teacher | During the fish printing (gyotakuing?), I will be listening for and encouraging students to generate new ways to prepare the fish for printing. I will ask students to review their 1st print to evaluate where and why they had more success. I will have them share their experiences with partners to build up a cooperative bank of ideas about best strategies.  |
| Student | Students will have to take notes on sedimentary rocks while they observe the rock samples looking for layering in the rocks and fossils details. They will also test out their fish printing strategies by trying multiple times + observing each print for areas of improvement | Student | Student will create their own fish printing procedure by observing the fish prints looking for anatomic details. They will try different strategies and will also have to advise each other on how to improve the quality of the prints. |
| Assess (look for) | I’ll look for intelligent observations of rock structures and understanding of fish anatomy + vocabulary mastery.I’ll also look for peer suggestions for ways to improve the printing procedure. | Assess (look for) | I will use their discussion question answers as a form of assessment. I will look to see if the explanations are clear & complete and if they are reasonable. I will also be listening to group members’ peer advice during the printing as they discuss pros and cons. |

12. Briefly describe how you will direct your students through the Phases of Inquiry.

**Initiation** *– Show rock samples with fossils + questioning to create curiosity*

**Invention** *– Encourage students to devise the best procedure to create a detailed gyotaku print.*

**Instruction** *(directions) - Introduce the TSI modes with examples and stories. Ask the students for definitions and examples.*

**Investigation** *– Students observe the sedimentary rocks & fossils + print their fish while gradually refining their process through observation and discussion.*

**Interpretation** *- Have students discuss & share their answers to the worksheet questions in a class discussion.*

13. What will be the *overarching* mode(s) of this activity?

*Experimentation, description and induction will be the overarching mode as the students learn to use their eyes to locate details in the rocks and in their fish prints that are recognizable fish anatomy and that show them the best way to improve the detail in their gyotaku prints.*

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 have very small classes. I also have many students who, because of vocabulary issues and slow processing speed, must be given instructions multiple times and then again one on one to check understanding. I’ll be spreading this activity out to make it more manageable. I expect it to take 3-4 full days if I push my students to work as quickly as possible.*