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

**Module 4: Ecological Aquatic Science**

Name: *Dan VanRavenswaay*

Activity: *Diffusion & Osmosis*

1. Why did you choose to do this activity?

*We are currently in a unit that spans a broad scope of marine biology and ecology topics. We are reviewing cellular respiration and other cellular processes as well as the major factors controlling regional primary productivity rates.*

2. What are your classroom learning goals?

*A deeper understanding of the concepts: diffusion & osmosis.*

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

*The concept of* diffusion *in relation to cells and homeostasis saturates (punny, yes?)*

*the biology and ecology topics of my marine science course. It’s one of those concepts*

*like* surface-area-to-volume-ratio *that you want your students to have a deep*

*understanding of during discussions and activities that assume they do.*

4. What date do you plan to start this activity? *April 4 or 5, 2013.*

5. *If applicable:* HIDOE standards this lesson will address: *Not applicable.*

6. Describe how this activity relates to at least one of the TSIA PD Themes.

Themes: Community, Metacognition, Science as a Human Endeavor, Observations and Inference, Modeling Science, Scientific Language, Connections

*Observations and inference – We will be making observations of what occurs over time to a dye added to one side of a gelatin, and to both whole plants and plant tissues exposed to different salt-in-water solutions.*

*Connections – We have introduced the terms diffusion and osmosis already as we have discussed water movement in and out of fish; homeostasis; and how dissolved gasses and other substances are transported in and out of cells.*

**Ocean**

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

*Homeostasis in regard to salt balance. Advantages of large surface area:volume ratio when an organism relies on diffusion moving things into or out of cells, e.g. simple organisms like flatworms that have no respiratory or circulatory systems, and phytoplankton that rely on diffusion for obtaining carbon dioxide and nutrient. We have already talked about why humans can’t drink seawater.*

8. 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**

9. How will you prepare your students for this activity? (For example, review of prior knowledge.)

*We start the talking about processes that take place inside cells, and reviewing our use of compound microscopes. (We just returned from Spring Break and it’s been a couple weeks since they had to do careful observations with a microscope.)*

10. 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.)

*There’s always a bit of confusion when learning osmosis that it’s the concentration of the water that controls the direction of net diffusion through a cell membrane.*

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

What types of questioning or approaches to discussion will you take to support student

engagement and learning? See questioning handout for suggestions (Mod 3 Binder under “TSI Pedagogy and online in Mod 3 PD section)

*‘Always plenty of clarifying and focusing questions with my students. We’ll use summarizing questions to help them verbalize the gist of the observations they’ll make of diffusion through the microscope and in the potato plugs.*

12. What ***TSI practices of inquiry teaching strategies*** will you focus on implementing to help your students meet your learning goals?

See TSI Practices of Inquiry teaching strategies handout for suggestions (Mod 4 Binder under “TSI Pedagogy” and online in Mod 4 PD section)

*This lesson is three activities (a demo, an observation through the microscope, and a short lab activity) where I am acting as the research director. Communication will be important while setting expectation, giving directions, and guiding/assessing progress through the activities.*

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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 summarize orally and on paper what they observed in both the osmosis activities. | Teacher | Prep for diffusion in water and through a gel demo.  Initiate discussion and ask, “Do you remember…?” |
| Student | Make oral and written summaries, to be shared first with a partner and then with the class. | Student | Remember and restate what they observed when we diffusion observations during our water-layering activity last fall. |
| Assess | Student participation/completion of oral and written summaries. | Assess | Student responses & questions. |
| **INSTRUCTION** | | | |
| Teacher | Directions for causing and observing osmosis in Rhoeo leaf epithelial cells.  Directions for preparing specimens and recording observations for osmosis in potato plugs. | | |
| Student | Prep microscopes, samples and data tables as needed. | | |
| Assess | Students are ready to continue to the investigation. | | |
| **INVESTIGATION** | | **INVENTION** | |
| Teacher | Supervise the room while students conduct the two activities (over two days?) | Teacher |  |
| Student | Make and record observations. | Student |  |
| Assess | Students will have completed data tables and recorded other relevant observations. | Assess |  |

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).

*See the chart above. I try to catch their attention and kindle interest. I provide access to equipment and supplies, and give directions for how to safely and successfully conduct the activities. Afterward, the students provide the data and observations as we summarize what we’ve observed and discuss where what we’ve seen might apply in ocean realm…homeostasis, etc.*

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

***Description*** *first, then* ***experimentation*** *as we make initial observations of diffusion and osmosis using a demo we’ve seen before (colored water layers), adding saline solution to a naturally-colored plant cell, and then make hypotheses as to what will happen when placing potato plugs into water or different salinities.*

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’m going to force myself to slow down with this lesson. I may even conduct it around other activities over three days. It’s a core concept worth learning well, and it will take as long as it takes.*