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**Final Network Reflections and Implementation Notes on Coral Bleaching Module**

Course/Course format: BIOL 1104 (General Biology 1)

BioInteractive Module: **HHMI BioInteractive modules on Earth Systems and Climate; Coral Bleaching and Ocean Acidification**

Quantitative skill focus: Graphing with Excel and data analysis using ocean temperature data and coral bleaching in various parts of the world.

Expected dates of implementation: Fall 2016 (September 2016)

1. What are the learning objectives (content) did you address in your course using the

selected BioInteractive materials?

Learning Objectives:

Through the use of HHMI modules and lab activities, students will be able to discern the complex inter-relationship of global warming, ocean acidification and coral reef health.

The students will be able to apply concepts in carbon cycling, pH, ecosystem in modeling the effect of increased CO2 to climate, acidification and coral reef ecosystems.

2. Briefly describe the pedagogical techniques you used to facilitate the BioInteractive

activities and reinforce the quantitative reasoning skill.

1. Lecture Assignment: Assigned “Earth Systems Worksheet” as homework in first week of class in lecture to understand Carbon Cycling leading to global climate change

http://www.hhmi.org/biointeractive/earth-systems-activity

2. Lab Activity on Ocean Acidification and Coral Bleaching (3 hrs)

Pre-lab for Week 2 lab: Assign students to watch videos about corals then answer pre-lab questions

<https://www.youtube.com/watch?v=ab6jV4VBWZE> (NASA video on the science behind global warming)

<https://www.youtube.com/watch?v=MgdlAt4CR-4> (NOAA Ocean Acidification - The Other Carbon Dioxide Problem)

<https://www.youtube.com/watch?v=_ZfGIKiSwwQ> (HHMI BioInteractive- coral bleaching video)

http://www.hhmi.org/biointeractive/coral-bleaching

Pre-lab questions:

1. In your own words, write or draw a diagram indicating the relationship between global warming and ocean acidification.
2. Construct a model predicting the effect of global warming and ocean acidification to coral reef health.

3. Lab Exercise on the Scientific Method, Ocean Acidification and Coral Bleaching (3 hr)

Part A. Class discussion on the inter-relationship between high CO2 concentration in the atmosphere, ocean acidification and coral reef health

Part B. Coral Bleaching Graphing Activity and Excel (HHMI)

Part C. pH and ocean acidification (modified activity from HHMI and HIMB (Hawaii Inst. Of Marine Biology)

http://www2.hawaii.edu/~himbed/forms/HIMB-Ocean-Acidification-Lab.pdf

Test the pH and hardness (measure of calcium and minerals) of soda, sea water, tap water and distilled water

Test the effect of pH after bubbling CO2 (from soda or from blowing air using straw) into sea water, tap water or distilled water

Part D. Student investigations on coral skeletons (adopted from HIMB)

Students will design an experiment to investigate the effect of pH/temp/water hardiness levels on corals.

For each species of coral/ urchin/ sand/ shells tested, test the effect of acidified seawater or tap water on the weight of corals and calcium and carbonate levels after 30 min or 1 hr of incubation. The students should be able to generate up to three separate graphs; pH, calcium, and carbonate. The treatment (control first, then treatment) can be plotted on the X-axis, while the parameter which was measured (i.e., pH, calcium, or carbonate) can be plotted on the Y-axis.

3. Did you make adaptations to the BioInteractive materials? If yes, please describe them

here. If no, please indicate why.

The HHMI activity on Ocean Acidification module was too simple for a college Biology class so I didn’t adopt it. I didn’t do any modifications in using the Coral Bleaching graphing activity. I assigned the Excel tutorials Module 1 and 3 without any changes.

4. Did you use supplemental materials with this module, please describe them (e.g. where

did you find them?).

I did use supplemental materials from other HHMI modules and Excel tutorials as described above. I also used a worksheet on the scientific method and an activity on the effect of ocean acidification on corals from the Hawaii Institute of Marine Biology (http://www2.hawaii.edu/~himbed/forms/HIMB-Ocean-Acidification-Lab.pdf)

5. What assessments did you use to measure student progress? Please either describe,

attach, or provide a link here.

I graded the worksheets submitted by the students on the HHMI activities on HHMI Excel tutorials and Coral Bleaching graphing activity. I assigned Excel activities every week so the students get ample opportunities to use Excel.

6. What would you do differently if you were to implement this module again?

I would skip doing the effect of ocean acidification on coral activity because detecting subtle changes in pH was very challenging and there was no detectable effect of acidification on the coral skeletons. I would simplify the instructions on using Excel on the Coral Bleaching activity and update it for the newest version of Excel. I would integrate the Coral Bleaching Activity with the Scientific Method. I would try to do a better job of discussing the activity in class and not just give the activity as an assignment with worksheets to answer.

7. Overall, how would you describe your experience with the BioInteractive modules?

Please provide any additional teacher notes here.

I really am grateful for the BIoInteractive modules. The quality of the module materials are excellent and very useful and interesting to the students. I found several modules that I will be using not only in this course (BIOL 1104, General Biology 1) but also in other courses I teach like Genetics, Research Methods and Cell Biology.