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Integration into Lesson Plan:

The Guam experience allowed me the opportunity to learn about our oceans. While I have always considered them in the big picture of the world, never have I ever mentioned oceans or oceanic chemistry in my entry-level chemistry classes that I teach at the tribal college. Attending the conference allowed me to hear concerns from Indigenous populations about ocean acidification, potential harmful effects to coral reefs, and the resulting impact on the fishing industry and ways of living. Before the conference, I never even knew what an atoll was, let alone the potential disappearance of them if ocean levels rise.

Hearing the stories at the institute impacted me deeply since there was such a void in my knowledge base. After I had time to reflect, I changed my overall curriculum to be more holistic and inclusive of the knowledge I did not have before. In particular, I made changes to units on pH and a water analysis/climate change laboratory module that I had incorporated a few years back. Being in Michigan, the research based water analysis lab focused solely on fresh water analysis since we are home to the largest bodies of fresh water in the world. However, since Native Americans are holistic learners, it just makes sense to make the picture even bigger and to include oceans in our analysis.

For the pH unit, I talk about atmospheric carbon dioxide creating dissolved carbon dioxide in the lakes and oceans. The resulting carbonic acid breaks down into bicarbonate ions, hydrogen ions and carbonate ions – all impacting the aquatic environment. Particularly new is the idea of loss of coral reef due to acidity. As I included pictures from my trip in the lessons, students appeared to be totally engaged with a strong desire to travel. Interesting to note, none of my students this past semester had ever seen the ocean – making the pictures even more intriguing to them.

The revised lab module now consists of both fresh water and seawater. The module commences with students researching climate change with a focus on how climate change impacts not only our fresh water systems but our oceanic environments as well. After the students participated in a literature review, I lectured on the material in an engaging manner to include their findings. Sharing pictures from my trip with the students researched coral reefs and their chemical makeup of calcium carbonate. We talked about pH and acid acidification, along with chlorides, nitrates, phosphates, dissolved oxygen, carbon dioxide, alkalinity and hardness and practiced testing for each of the substances.

After spending time learning how to use the HACH 900 Multi-parameter handheld colorimeters and testing devices, students completed an analysis on four

water samples. While two of the samples simulated fresh water (one sample was real and one was doctored to be slightly more acidic), the other two samples simulated oceanic water (both had chloride added with one sample set at a pH of 8 and the other at 7.5). Students were faced with the task of identifying each of the samples and stating which samples were thought to be results from changes in the climate.

Yet another lesson from the institute included the impact that science education has on shaping policy and decision-making. I found it truly invigorating to learn that science logic was used to prevent destroying an important coral reef system as the U.S. seeks to increase their military presence on Guam. Although Guam is a long way away, being able to relate instances like this to the students brings home the importance of a science education.