Activity

2

Understanding Environmental Problems through Chemistry

Educator: Sonya Doucette, Faculty, Chemistry and Environmental Science
Context: In-class; General Chemistry 163
Keywords: POGIL, sustainability, flipped classroom
Student Activity Time: 50 minute class period

Students used equilibrium chemistry to uncover the concept of chemical buffers in relation to environmental problems.

Introducing the Reflection Activity

Pointing students' attention to the real world value and implications of science is an important part of teaching, especially in the basic sciences. Students were introduced to the concept of chemical buffers through a set of in-class, group activities. The sequential activity prompts students to recall concepts covered earlier in the course and concludes with an application activity related to ocean acidification. The purpose of this activity is to assist students in recalling and applying chemistry concepts to real world issues.

The educator designed the in-class activity with the POGIL-IC model, Process Oriented Guided Inquiry in Context. The model, used by some chemistry educators, enables students to learn concepts through discovery with a sequence of scenarios that model the topic at hand. The educator designed this activity with three scenarios to scaffold up to the concept of buffers. After a brief introduction of the topic and assignment at the beginning of class, students were separated into groups of three or four and given the activity sheet to work on during the class session while the educator assisted groups with questions. The first scenario prompted students to recall concepts such as Henry's law, Le Châtelier's principle, and acid-base equilibrium from the prior course in the sequence, with the first five questions. Scenario two introduced a more complicated set of conditions, prompted students to recall solubility equilibria, and questions for students to consider the same principles. The final scenario, which was completed by some students outside of the class time, introduced the concept of ocean acidification and prompted students to recall their understanding of the concepts in scenarios one and two. The final scenario also pointed students to consider the implications of carbon cycling on oceans.

The educator has seen several outcomes related to this activity including: heightened interest in chemistry, curiosity of other applications of science knowledge, and expanded understanding of scientifically relevant political topics. As a result, some students considered or changed their major to chemistry or environmental science and had a greater appreciation of the subject matter.

DIGITAL LIBRARY CONTENT

- 2.1 Exploring Ocean Acidification Assignment
- 2.2 Group roles handout

Recreating the Reflection Activity

	Description
1	Assign 3-5 sections of the textbook to read and pre-lecture questions. If the topic is complex, create and share a YouTube video to demonstrate solving an example problem. Through this means, cover or review the foundational concepts such as: Henry's law, Le Châtelier's Principle, acid dissociation for polyprotic acids, pH, solubility equilibria, and dissociation of solids in solution.
2	Use pre-lecture questions to determine content necessary for class.
3	Hand out the "Exploring Ocean Acidification" assignments to students in groups of 3 - 4.
4	Assign roles to each group member.
5	Give students the remaining class time to complete the assignment.
6	Grade students for participation.

In the Words of the Educator: Tips and Inspiration

Maintain group roles. I assign three roles at the beginning: manager, document controller, and a reader. The manager keeps the group moving along, the document controller is writing everything down, and their job is not to write down anything until everyone in the group understands it and comes to an agreement on the answer. This helps to prevent one student in a group from falling behind. If it's a group of four, there's a cheerleader, to keep everyone motivated and on task. The reader shares the assignment information with the group so that everyone is moving at the same pace and on topic. You have to keep reminding them about the roles, since I use it throughout the term.

Make the assignment as clear as possible. This one is pretty clear, but application problems need to be very clear. Some of the assignments I have found elsewhere require some changes to the wording. Making sure this assignment is very clear and sequential.

What was the inspiration for the reflection activity? In my own experience as an undergraduate, I hated chemistry because I did not understand why I was learning what I was learning. In my first teaching role, I worked at another community college and made sure that my course was very applied in nature and saw how excited the students got about the class. It was like a breath of fresh air because using applications of chemistry, students would tell me how much they appreciated knowing why they were learning something. During my time on the other campus, and my postdoc I worked with people who were doing innovative things to help support students' metacognition in science classes.

I've known about the POGIL approach for a little while and attended some workshops on it. My research background is carbon cycling and I wanted to use it as a way to make the content in chemistry relevant.