Background
- Motivating student engagement in introductory science courses can be challenging when students tackle scientific principles divorced from real-world applications (Allen et al., 1996).
- Hands-on analysis of real-world data as part of students' scientific education can help them achieve content and skill learning goals (Manduca and Mock, 2002).
- Ocean acidification is a current, locally-relevant environmental problem that can be explained using principles of equilibrium and acid-base chemistry.

Motivating Hypotheses
We hypothesized that introductory chemistry students who completed a hands-on data analysis activity applying basic chemical concepts to explain the scientific underpinnings of the compelling real-world problem of ocean acidification would:
- Increase their motivation to master the relevant chemical concepts, helping them achieve course learning goals
- Better appreciate the importance of the problem of ocean acidification and more deeply understand its scientific underpinnings

Activity Development
We developed and pilot tested an ocean acidification guided inquiry-based data analysis activity using real water chemistry and oyster larval growth data from the Whiskey Creek Hatchery in Netarts Bay, Oregon (published in Barton et al., 2012). The activity:
- Leads students through hypothesis generation, calculations, graphical analysis and data interpretation as they work directly with real data provided in a Microsoft Excel workbook.
- Is explicitly designed to complement scientific skill and content learning objectives in advanced high school and introductory undergraduate chemistry courses.

Pilot Testing
The lesson was pilot tested with seven classes of Advanced Placement Chemistry students in three different Bellevue School District high schools (~200 students).
- During pilot testing, pre- and post-activity surveys assessed changes in students' perception of the problem of ocean acidification and their confidence in explaining ocean acidification to others, as well as their ability to describe the chemical basis for ocean acidification.

Conclusions and Implications
- The ocean acidification data analysis activity developed and tested here helped introductory chemistry students to master equilibrium and acid-base chemistry through engagement with real scientific data about a locally-relevant environmental issue they considered important.
- Incorporating real-world data analysis that allows students to investigate authentic problems can be an effective teaching strategy in introductory science classes.
- Students can be effectively introduced to environmental or other issues of human interest in the context of the scientific principles integral to the curriculum while also increasing their motivation to master the core scientific principles of the discipline.

Student Outcomes in Pilot Testing the Data Analysis Activity
Students’ ability to correctly apply chemical principles in their explanations of the scientific concepts behind ocean acidification improved after completing the activity.

- Explain how increasing CO₂ in the atmosphere is changing ocean chemistry.
- Explain how organisms with calcium carbonate shells are affected by ocean acidification.

Students’ confidence in their understanding of ocean acidification and their perception of the importance of the issue both increased after completing the activity.

- If a friend asked you to explain ocean acidification, how confident would you be with your answer?
- How important do you consider the problem of ocean acidification?

Use this in your class!
All activity materials and supporting lesson plans are available online (visit http://bit.ly/ZCLVMH or scan QR code on right).

Literature Cited

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