University of Louisville
Department of Chemistry
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Literature Seminar

When: April 4, 2024
Time: 12:00 p.m.
Location: CBLL-16

Support for Student: Enhancing Conceptual Understanding through Science Practices

Abstract:

The vision of science education introduced in the Framework for K-12 Science Education and the *Next Generation of Science Standards (NGSS)* in the United States calls for students to engage in eight science and engineering practices as part of their educational experience. These are performance expectations of what students are expected to be able to do upon their graduation [1]. However, existing studies have shown that traditional chemistry classrooms rarely engage in these practices as recommended. Jarod and William explored the initial efforts made by secondary science teachers to understand and enact NGSS-aligned teaching [2]. These teachers were part of the participants who attended a professional development workshop centered around the importance of incorporating science practices into classroom activity. Even though the teachers revised their lesson plans to include strategies that meet the stated recommendations, a critical look into the purposes for which they used those strategies was found to be misaligned with the demands of the NGSS. Barbara et al. investigated students in foundational-level inorganic chemistry reasonings of molecular orbitals (MO) to identify some misconceptions that students nurture when using the science practice of modeling to conceptualize inorganic reactions [3]. Students exhibited an incomplete understanding of the information encoded in MO sketches and did not attribute meanings to the diagram. Judith and Elizabeth conducted a research study on discipline-specific ways to improve students' conceptual understanding through instruction that specifically incorporated science practices [4]. The study used an experimental design approach and modeling as part of instruction for a group. The result showed that over 60% of students in the modeling instruction class demonstrated mastery of the concept at the end of the semester as opposed to those in the teacher-led class. Learning science is best by doing science, and the two should not be treated as mutually exclusive concepts. It gives students tools and vocabulary to articulate their own misconceptions, positioning science as being relevant and providing students with opportunities to develop their scientific skills.

References:

1. The National Research Council. A Framework for K−12 Science Education: Practices, Crosscutting Concepts, and Core Ideas; *National Academies Press: Washington, DC,* 2012.
2. Kawasaki, J., & Sandoval, W. A. (2020). Examining teachers' classroom strategies to understand their goals for student learning around the science practices in the Next Generation Science Standards. Journal of Science Teacher Education, 31(4), 384–400. https://doi.org/10.1080/1046560X.2019.1709726
3. Reisner, B. A., Kinkaid, M. M., Pratt, J. M., Bentley, A. K., Stewart, J. L., Smith, S. R., Raker, J. R., & Lin, S. (2024). How Do Inorganic Students Represent Molecular Orbitals? A Multi-Institutional Study from the Foundation-Level Inorganic Chemistry Course. Journal of Chemical Education, 101(2), 456–466. https://doi.org/10.1021/acs.jchemed.3c00823
4. Department of Chemistry, Eastern Kentucky University, Richmond, Kentucky, Jenkin, J., Howard, E., & Department of Technology, Valvoline Inc., Lexington, Kentucky. (2019). Implementation of Modeling Instruction in a High School Chemistry Unit on Energy and States of Matter. Science Education International, 30(2). https://doi.org/10.33828/sei.v30.i2.3