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C. EUGENE BENNETT
DEPARTMENT OF CHEMISTRY

Exploring students' epistemic modeling across general chemistry and organic chemistry

Morgan Balabanoff, PhD
Department of Chemistry, University of Louisville

Scientific models are explanatory and predictive frameworks used to make sense of natural phenomena. In chemistry, models are ubiquitously employed to describe unobservable atomic- and molecular-level phenomena. Modeling knowledge can be described across two dimensions: thinking with (operational) and thinking about (epistemic) models. Engaging in operational modeling allows students to apply models to communicate, explain, or predict a phenomenon, while epistemic modeling allows students to reflect on the process (and purpose) of modeling, and the nature of science. Students often struggle in identifying multiple models referring to the same phenomenon and selecting the appropriate model for a specific context. It has been well documented that students often struggle in chemistry due to (1) the expectation to utilize scientific models without sufficient instruction along with (2) the necessity of models to make sense of chemical phenomena we cannot see. This work investigates students' epistemic and operational modeling knowledge as they generated models across foundational topics in general chemistry and organic chemistry. Semi-structured interviews elicited the sophistication of epistemic and operational modeling knowledge as students generated models to explain atomic phenomena and to predict acid-base equilibria. Understanding how students generate and use models while characterizing their epistemic modeling knowledge will guide the implementation of targeted supports for students in chemistry as they develop their science practice of modeling.

These findings serve as the foundation for the development of instructional resources, interventions, or assessments targeting epistemic chemistry modeling knowledge.

Date: Mon, March 24, 2025
Time: 3:30-4:30 pm
Location: Clark Hall 312