HOPE COLLEGE CHEMISTRY SEMINAR

Scientific Reasoning in Chemistry: How can Instruction Promote Measurable Growth?

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Abstract

Chemistry departments commonly offer courses for non-science majors such as University of Northern Colorado’s CHEM 101 Chemistry for Citizens and Miami University’s CHM 111 Chemistry in Modern Society, which are aligned with the Association of American Colleges and Universities liberal education initiatives. In accordance with liberal education goals, such courses aim to improve students’ critical thinking (CT) skills in addition to improving chemistry content knowledge. However, because CT has a multitude of ill-structured dimensions and definitions, there is difficulty in accurately evaluating if and how these non-majors courses influence students’ CT skills. To make measurement effective and efficient, we have narrowed CT to a construct that is useful to chemists: Scientific reasoning (SR) or students’ ability to examine data, make inferences, and generate hypotheses. With SR at its center, we conducted a five-semester study of Chemistry in Modern Society to better understand which types of reasoning (proportional, probabilistic, correlational, variable control, mass conservation, hypothetico-deductive) require instructional focus, and how particular instructional materials and approaches could help to reform instruction, improve learning gains, and improve SR skills. Results provide important implications for curricular and course design, particularly in cases where improving CT is a key goal.

Biography

Dr. Ellen Yezierski received a B.S.Ed. in chemistry from the University of Arizona and taught high school chemistry for seven years. Dr. Yezierski received an M.Ed. in secondary education with an educational psychology emphasis from Northern Arizona University and a Ph.D. in Curriculum & Instruction from Arizona State University in the lab of James Birk. Dr. Yezierski served as a faculty member in the Department of Chemistry at Grand Valley State University where she and collaborator Dr. Deborah Herrington designed and implemented a novel professional development model known as Target Inquiry (TI), whose results have been presented to the Chemical Sciences Round Table at the National Academies. Dr. Yezierski has implemented the TI model at Miami University, where she is currently an Associate Professor in the Department of Chemistry & Biochemistry, thus building a rich “lab” to investigate chemistry teaching and learning. Other research areas in the Yezierski Group also focus on pedagogy and teachers.