MOVING BEYOND “CRITICAL THINKING”: SUPPORTING AND ASSESSING 3-DIMENSIONAL LEARNING IN HIGH SCHOOL AND COLLEGE

Many modern reform efforts in science education, including those built around the Next Generation Science Standards and The Framework for K-12 Science Education, place substantial emphasis on students using disciplinary knowledge to predict, explain, and model phenomena. Focus on integrating ideas fundamental to a discipline, practices that characterize work in science, and concepts that bridge disciplines (known as “3-dimensional learning”) can position students as knowers and doers of science. Here, I explore how we might support and assess 3-dimensional learning in both high school and college contexts. My research in the high school space indicates that adapting college-level, evidence-based conceptual progressions for use in high school has the potential to aid students in connecting molecular-level structure to measurable properties. At the college level, our work is part of a large interdisciplinary effort to transform foundational courses in biology, chemistry, and physics at Michigan State University to better align with research on how people learn. We have characterized the extent of course transformation over time and in different disciplinary contexts via analysis of exams using the “3-dimensional Learning Assessment Protocol”. This analysis indicated that change is powerfully affected by factors at the course and departmental levels. I will discuss our ongoing efforts toward undergraduate course reform with especial emphasis on engaging students in science and engineering practices in the context of organic chemistry. In particular, I will focus on examination of student argumentation from spectral evidence.