

Quantitative Reasoning - Mathematical Modeling in the Sciences

This session is part of an invited session: The Teaching of Modeling. The session will present pilot research being conducted in undergraduate biology courses at multiple universities. A brief overview of quantitative reasoning in the sciences will be provided, including presentation of a Quantitative Reasoning learning progression framework with three progress variables: Quantitative Act and Literacy, Quantitative Interpretation, and Quantitative Modeling. Two measures associated with the quantitative learning progression will be shared: 1) QA-QL measure of ability to quantify variables within a biological context and ability to apply arithmetic and algebraic skills within context; 2) QI-QM measure of ability to interpret quantitative biological models and understanding of building quantitative models. The QA-QL measure has the potential to be a diagnostic assessment of students' basic quantitative reasoning ability, providing formative feedback to the instructor which informs the need for supplemental instruction in quantitative skills or just-in-time teaching of quantitative skills. Addressing gaps in students' quantitative reasoning ability is fundamental to meaningful implementation of modeling in the sciences. The QI-QM measure is designed as a formative pre-post assessment of students' ability to apply models to determine trends, make predictions, translate between models, and make revisions to a model, as well as the ability of students' to create their own models and reason with those models. Preliminary data from a pilot of the assessments will be presented.