How Do We Know What Students Know?  
The Development and Evaluation of a Concept Inventory

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As chemists, we strive to produce quality data about chemical systems. This data allows us to support our claims regarding the reactions or the compounds we study. As chemistry educators we need to be equally cognizant of the quality of the data we collect when making educational measurements. Educational data can suffer from a variety of threats to its validity and reliability, thereby lowering our ability to support claims about student learning. Obtaining quality data begins during the development phases of an educational instrument and continues throughout the lifetime of an instrument. Both qualitative and quantitative investigations can be used to provide evidence in support of the validity and reliability claims of instrument-based educational data. In this seminar, I will discuss some of the methods used in several of my group’s research projects on educational measurement and how data from these methods is used to support how we know what students know. Details will be presented from qualitative and quantitative studies from the development and analysis of the Thermochemistry Concept Inventory.

Jack Barbera is an associate professor at Portland State University who specializes in chemistry education research. His work seeks to better understand how educators define and measure student success in an academic setting. The Barbera group has developed a number of assessment tools to more effectively, and efficiently, gauge students’ chemistry content knowledge as well as various factors important for student motivation such as attitude, self-efficacy, interest, and effort beliefs. Their assessment instruments and related studies have been published in the Journal of Chemical Education as well as Chemistry Education Research and Practice. Current classroom-based projects are investigating the motivational impacts of various teaching practices including Flipped Learning, Deliberative Democracy Practice, and Process Oriented Guided Inquiry Learning. Additionally, the Barbera group has ongoing instrument-based projects regarding the development of students’ science identity, student engagement in group learning activities, and the assessment of higher-order cognitive skills.

Professor Barbera earned a dual-doctorate (physical chemistry and chemistry education) in 2007 from the University of Colorado-Boulder. He worked with W. Carl Lineberger (physical chemistry) on the femtosecond dynamics of anionic systems and with Carl Wieman (physics education) on the development of assessment instruments and on the design and testing several chemistry simulations for the PhET project (http://phet.colorado.edu). He is the current chair of the American Chemical Society Chemistry Education Research committee.

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Host: Annie Luke  
Refreshments will be served prior to the seminar.  
Visit: chem.umn.edu/chemistry-events for information on upcoming seminars.