

Development, evaluation, and implementation of an assessment instrument in general chemistry

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Developing curriculum and evaluating curricular interventions depends on the availability of assessments to measure differences in student performance. Within chemistry education, assessments have been designed to evaluate instructional and educational interventions, and measure students' understanding of specific chemistry concepts. To make meaningful and informed curricular decisions, assessments need to be evaluated to determine their ability to capture their intended measure. Oftentimes, psychometrics is employed to evaluate this functionality and determine if assessment outputs are meaningful. In this present work, an assessment was developed to measure students' conceptual understanding of the broad range of topics introduced during a year-long sequence of general chemistry. In general chemistry courses, students are expected to gain a working knowledge of many fundamental principles of atomic and molecular behavior that they can use to explain observations of phenomena. However, general chemistry is often accused of being a "mile wide and an inch

deep" making it very difficult to assess as the range topics often requires introducing a variety of chemical systems and contexts. To account for challenges which may arise from different systems and contexts, this assessment instrument relies on a single context: water. The Water Instrument was developed using an exploratory sequential design targeting ACS General Chemistry anchoring concepts. Psychometric evaluation of assessment data supports the use of the Water Instrument to draw conclusions about students' general chemistry conceptual knowledge. Assessments such as these have been widely developed and published within the chemistry education community but considerably less attention has been given to how instructors use assessments in the classroom or engage in data-driven curricular changes. Current use of research-based assessment data may be inhibited by lack of time or support. Therefore, this work aims to provide instructors with tools to evaluate assessment data to support the use of this assessment. The development of these supports is based on a qualitative study investigating how general chemistry educators engage with research-based assessment data which serves as the foundation for subsequent practitioners to improve their data-informed practices. By facilitating knowledge sharing and collaboration between general chemistry practitioners, the goal is to increase the use of research-based assessments in the classroom and bridge researchers who design assessments and the educators who functionalize them.