

KNOWING WHAT THEY KNOW IS HALF THE BATTLE: INVESTIGATING STUDENT CONCEPTIONS OF STOICHIOMETRY

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Stoichiometry is a core topic in high school chemistry, yet it is often one of the most daunting for students as the extensive range of chemical and mathematical concepts required for understanding make this topic complex and challenging for student learning (Wink & Ryan, 2019; Ramful & Narod, 2014). The long-standing interest in research into student learning has afforded conceptions, misconceptions and alternative conceptions as vehicles through which researchers can investigate student understanding (Taber, 2015; Gilbert & Watts, 1983). Two-tier diagnostic instruments have been used extensively in previous research for this purpose where they have been useful in obtaining data regarding students' conceptions of the relevant subject matter (Treagust, 1988; Soeharto et al., 2019). This study involved development of a two-tier diagnostic instrument to investigate the interplay between stoichiometry and mathematics. There were four steps to the development and refinement of the two-tier diagnostic instrument: defining the scope of the project, constructing the first tier, obtaining alternative conceptions, and developing the second tier. With multiple refinements during the design phase, the development of the instrument was informed by face validation from ten 'critical friends' alongside written responses from both undergraduate and graduate students ($n = 24$) and think-aloud interviews ($n = 12$). The final version of the two-tier diagnostic instrument contains 21 items comprising 14 chemistry items and 7 mathematics items. Development of a two-tier diagnostic instrument that addresses two interrelated subject matter areas is a novel application of the two-tier diagnostic approach and the implications of this will be presented.

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