

CREATION AND VALIDATION OF THE ALGEBRA CONCEPT INVENTORY IN THE TERTIARY CONTEXT

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In college, taking algebra can prevent degree completion. One reason for this is that algebra courses in college tend to focus on procedures disconnected from meaning-making (e.g., Goldrick-Rab, 2007). It is critical to connect procedural fluency with conceptual understanding (Kilpatrick, et al., 2001). Several instruments test algebraic proficiency, however, none were designed to test a large body of algebraic conceptions and concepts. We address this gap by developing the *Algebra Concept Inventory (ACI)*, to test college students' conceptual understanding in algebra.

A total of 402 items were developed and tested in eight waves from spring 2019 to fall 2022, administered to 18,234 students enrolled in non-arithmetic based mathematics classes at a large urban community college in the US. Data collection followed a common-item random groups equating design. Retrospective think-aloud interviews were conducted with 135 students to assess construct validity of the items.

2PL IRT models were run on all waves; 63.4% of items (253) have at least moderate, and roughly one-third have high or very high discrimination. In all waves, peak instrument values have excellent reliability ($R \geq 0.9$). Convergent validity was explored through the relationship between scores on the ACI and mathematics course level. Students in "mid"-level courses scored on average 0.35 SD higher than those in "low"-level courses; students in "high"-level courses scored on average 0.35 SD higher than those in "mid"-level courses, providing strong evidence of convergent validity. There was no consistent evidence of differential item functioning (DIF) related to examinee characteristics: race/ethnicity, gender, and English-language-learner status.

Results suggest that algebraic conceptual understanding, conceptualized by the ACI, is measurable. The final ACI is likely to differentiate between students of various mathematical levels, without conflating characteristics such as race, gender, etc.

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