Validity of the Algebra Concept Inventory in Predicting Academic Outcomes in College

Saturday, January 11, 2025

8:30 AM - 9:00 AM

603 (Level Six, Seattle Convention Center Arch at 705 Pike)

Session

NSF Special Session on Outcomes and Innovations from NSF Undergraduate Education Programs in the Mathematical Sciences, III

Abstract

Algebraic conceptual understanding is a critical mathematical skill. However, until recently, larger-scale validated assessments in algebra consisted mostly of computational tasks, or only assessed a narrow range of conceptions in a focused domain. Moreover, few instruments had been validated for college students. In this research, we explore the predictive validity of the recently-validated Algebra Concept Inventory (ACI); in particular, whether college students' ACI scores predict math course grades, STEM-major math course completion, and STEM vs. non-STEM degree attainment. We also explore whether the ACI score explains outcome differences by race/ethnicity/gender. The ACI was designed to assess student conceptions of core mathematics concepts that are critical for algebra, such as variable, equivalence, and function. Items were designed to be accessible to students with all levels of algebra experience, starting with students who have taken or are currently enrolled in elementary algebra in college (or who have prior experience with Algebra I in secondary school). Data for students enrolled in any mathematics course at or above elementary algebra at the largest community college at the City University of New York (CUNY) were collected and merged with an existing dataset of ACI scores (based on 2pl IRT models). Regression as well as mediation analysis using the KHB method were used in order to explore predictive relationships between ACI score and subsequent academic outcomes. On average, one standard deviation (SD) increase in ACI score correlated with a 0.4 increase in grade points for a student's enrolled mathematics course. ACI scores also significantly predicted whether a student would complete each of the five core STEM major mathematics requirements, given their current course level. For every one SD increase in ACI score, students were also 5.1 percentage points more likely to complete a STEM vs. non-STEM degree when controlling for current course level. ACI score predicted STEM degree completion more strongly than course grade alone. ACI scores also explained a significant portion of differences in math course grade by race/ethnicity, illustrating the importance of instruction in algebraic conceptual understanding for equitable learning and course outcomes.

Presenting Author

W

Claire W. Wladis

BMCC/CUNY and the CUNY Graduate Center

Authors

M

Eileen Murray
CUNY Graduate Center

H

Alyse C. Hachey
University of Texas at El Paso

M

Nils Myszkowski
Pace University

S

Benjamin Sencindiver
University of Texas at San Antonio

O

Kathleen Offenholley
BMCC/CUNY

S

Jason Samuels
BMCC/CUNY

A

Geillan Aly
CUNY Graduate Center

View Related