

First Generation Calculus Students' Beliefs

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The retention of college students in the Science, Technology, Engineering, and Mathematics (STEM) fields has been widely studied (e.g.; Rasmussen & Ellis, 2013; Sithole et al., 2017). Less research has focused on students traditionally underserved by the educational system (e.g., Carver et al., 2017). Understanding students' beliefs in mathematics can improve achievement and motivation (Muis, 2004), which has inspired research on the beliefs of several student populations (e.g.; Berkaliyev & Kloosterman, 2009; Sangcap, 2010; Sintema & Jita, 2022; Yavus & Erbay, 2015). There is still a need to explore the beliefs of first-generation students, as little confidence in the ability to solve mathematics problems is related to lower academic performance (DeFreitas & Rinn, 2013). Since calculus is key for college STEM retention (Rasmussen & Ellis 2013), our study explores the beliefs that first-generation calculus students hold based on the Indiana Mathematics Beliefs Scale (IBMS) to inform on the retention of first-generation calculus students.

Methods

The study was conducted at a public, Ph.D.-degree granting institution in the midwestern United States implementing a quantitative research approach (Johnson & Christensen 2019). Demographic information such as gender and major was collected via a questionnaire. The IBMS (Fennema & Sherman, 1976; Kloosterman & Stage, 1992) contains 36 Likert-type scale questions measuring six beliefs about mathematical problem-solving, each including six questions that positively or negatively reflect it. The extensively used and validated (e.g.; Ayebo & Mrutu; Berkaliyev & Kloosterman 2009) IBMS survey was distributed to 16 calculus classes with a total of 362 students. We collected 224 responses (61.9% response rate) and analyzed responses to identify students who self-identified as first-generation by reporting the highest degree achieved by one of their parents being less than a four-year degree in college. In the analysis, we assigned numerical values to the responses and adjusted for questions that had negative statements toward the beliefs. Then, we used descriptive statistics and an independent sample t-test on the average score of students by belief.

Results & Discussion

From the 94 first-generation students' responses to the demographic survey, we found that this was composed of 40 women, 53 men, and one non-binary student. We also found that within this subset of participants, 14 were black, 41 were Hispanic, and none were indigenous. Respondents most strongly believed that "understanding concepts are important in mathematics" and "mathematics is useful in daily life," but this is not the case for the belief that "there are word problems that cannot be solved with simple, step-by-step procedures." Using an independent samples t-test to compare the average score of each belief for both men and women, there were no significant differences seen ($p>0.05$).

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