

Exploring Summer Bridge Program Participants' Sense of Belonging in Mathematics

Skylyn Irby
The University of Alabama

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Students often leave STEM majors after taking math courses within the first two years of college (e.g., Chen et al., 2013), and historically underrepresented college students are less likely to persist in STEM areas compared to their peers (e.g., Alkhasawneh & Hobson, 2011). A sense of belonging in math may improve students' desire to persist in STEM (Good et al. 2012), so programs that support the development of a math sense of belonging could be a critical component of STEM retention. Summer bridge programs contribute to retention efforts of underrepresented STEM students through diverse representation, community, mentorship, and tutoring. However, little is known about how these programs influence math sense of belonging. This project explores the development of participants' sense of belonging, confidence, and identity in math while involved in a summer bridge program. In particular, I ask: (1) How does the math sense of belonging of bridge program participants change or differ throughout their participation in a bridge program?, and (2) What aspects of bridge programs do participants value and why? How do these valued aspects relate to their sense of belonging in math?

Theoretical Framework

This work is grounded in the academic and social integration components of Tinto's Conceptual Schema for Dropout from College (1975), which identifies academic and social systems as contributors to one's dropout decision. This theoretical framework has been widely adapted for researching retention in STEM.

Methods

Data were collected using surveys and semi-structured interviews. The survey instrument included the 30-item Good et al. (2012) sense of belonging in math scale, the six-item Lubienski et al. (2021) math confidence scale, and short answer questions about students' identity and sense of belonging in math. A coding scheme for belonging explanations, adapted from Rainey et al. (2018), was used for initial content analysis and coding reasons such as math identity, interpersonal relationships, personal interest, or competence. I used qualitative analysis methods and descriptive statistics to produce results.

Results and Conclusions

Participants' feelings of membership and acceptance as measured by the Good et al. (2012) sense of belonging in mathematics scale, declined between the start and end of the summer bridge program. However, this decrease may be attributed to the intensive nature of summer courses. Despite these challenges, students valued the mentoring and program components.

Interviews with one participant revealed confidence in their sense of belonging in math with the reasoning being personal interest and competence, often feeling reassured by peers and mentors in the program. Initial findings indicate a decline in students' overall sense of belonging in math after their first college summer math course. Yet, the positive experiences with the bridge program suggest that continued participation may lead to an improvement in their sense of belonging over time.

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Skylyn Irby, The University of Alabama, Department of Mathematics

THE UNIVERSITY OF
ALABAMA
College of Arts & Sciences

PURPOSE & MOTIVATION

- Attrition in STEM
- Less than half of American students who enroll in STEM undergraduate programs go on to earn a STEM degree (Wilson et al., 2012).
- Historically underrepresented students are less likely to persist in STEM areas in comparison to their counterparts at the postsecondary level (Alkasawneh & Hobson, 2011; Riegler-Crumb et al., 2019)
- Students often leave STEM majors after taking mathematics courses within the first two years of college (Chen et al., 2013; Seymour & Hunter, 2019)
- Research has revealed that the first year of college is a critical period for attrition in STEM (Chen, 2013), particularly as the transition to college involves students negotiating both academic and personal stressors (Ruble & Seidman, 1996).
- Sense of Belonging (Strayhorn, 2012), Identity (Estrada et al., 2018), and Self-efficacy/Confidence (Rincón, 2018) are some variables that often impact one's ability to successfully academically and socially integrate in STEM.

RESEARCH QUESTIONS

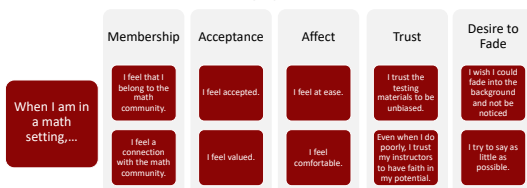
1. How does the math sense of belonging of bridge program participants change or differ throughout their participation in a bridge program?
2. What aspects of bridge programs do participants value and why? How do these valued aspects relate to their sense of belonging in math?

THEORETICAL FRAMEWORK

STEM retention programs are dynamic environments for integrating academic and social systems. This work is grounded in the academic and social integration components of Tinto's Conceptual Schema for Dropout from College (1975), which identifies academic and social systems as contributors to one's dropout decision. This theoretical framework has been widely adapted for researching retention in STEM.

METHODS

Mathematics Sense of Belonging Scale (Good et al., 2012)

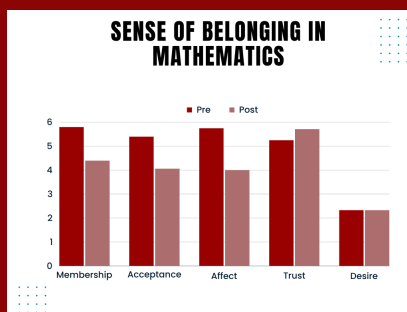


Coding Scheme for Belonging Explanations (Rainey et al., 2018)

Code	Reason for belonging	Reason for not belonging
Interpersonal relationships	Feels socially connected with peers and/or faculty members. May share common interest with peers.	Lacks a social connection with peers. Feels socially different, does not fit in.
Math Identity	Math is a part of their identity as a person.	Lacks a personal connection to the major or material.
Personal Interest	Expresses personal interest in course subject or major.	Explicit lack of interest. May find the material boring or unrelated to their reason for choosing their major.
Competence	Feels like they understand major-related material or receives good grades in major-related courses.	Feels like they do not understand major-related material well or receives poor grades in major-related courses.

MAIN FINDINGS

Initial findings indicate a **decline** in **underrepresented STEM bridge program participants' overall sense of belonging in math** after their first college summer math course.



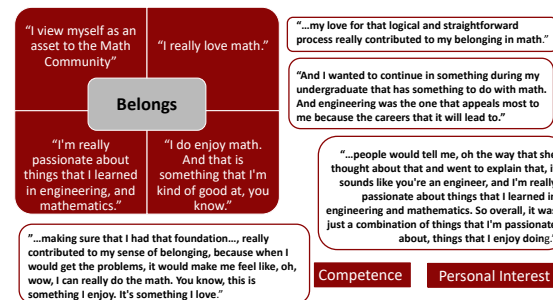
SITE & SAMPLE

- Large, graduate degree-granting, research-intensive PWI, Southeastern part of the United States
 - Louis Stokes Alliance for Minority Participation (LSAMP)
 - 4-week Summer Bridge Program
 - 16 Underrepresented incoming freshmen in STEM

RESULTS

Excerpts of a Student's Responses

Reasons for Belonging



CONCLUSION

- Participants' feelings of membership and acceptance as measured by the Good et al. (2012) sense of belonging in mathematics scale, declined between the start and end of the summer bridge program.
- Interviews with one participant revealed confidence in their sense of belonging in math with the reasoning being personal interest and competence, often feeling reassured by peers and mentors in the program.
- Initial findings indicate a decline in students' overall sense of belonging in math after their first college summer math course. Yet, positive experiences with the bridge program suggest that continued participation in LSAMP may lead to an improvement in their sense of belonging over time.

FUTURE WORK

- More rounds of coding to draw conclusions from interview data and open-ended survey questions
- Connections among students' sense of belonging in mathematics, mathematics identity, and mathematics confidence
- Longitudinally follow up with participants as they persist through their first year of mathematics courses

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