Navigating Calculus: Challenges and Assets of First-Generation STEM Students

Carlos Acevedo
Texas State University

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Students tend to encounter challenges when facing gateway courses, such as calculus. For example, calculus courses tend to have high failure rates (Bressoud et al., 2013), discourage students from persisting because of certain classroom experiences (Rasmussen & Ellis, 2013), and have an implicit mechanism that pushes students away from STEM (Olson & Riordan, 2012). There is little research on how first-generation college students navigate calculus. However, there is research that has shown these students often face challenges throughout their college journey, such as financial hardship, work and have caregiving responsibilities, gaps in academic preparation, and feelings of isolation (Chen & Carroll, 2005; Ardoin, 2017; Covarrubias et al., 2019).

Nevertheless, Gutiérrez (2008) warns that research on the achievement gap overshadows the advancement of marginalized groups and "suggest[s] a research agenda that focuses on advancement, on excellence, and on gains within marginalized communities" (p. 362). Therefore, this poster will also present findings on the assets first-generation college students activated while navigating through calculus. That is, I will present what specific challenges they encountered throughout their calculus journey and the assets that they employed that supported their persistence. To stay consistent with literature, I define first-generation college students as those whose parents or guardians have not earned a four-year degree. My specific research questions are:

1. What obstacles do first-generation STEM students encounter as they transition into and navigate their calculus journey?
2. What assets do first-generation STEM students draw on to support their persistence in their calculus journey?

I will note that when I refer to their calculus journey, I am including what they experienced within the university and outside the university. Sometimes these obstacles get intertwined with their experience taking their semester long course, which participants still need to navigate with challenges that happen outside the classroom. Moreover, all participants passed their calculus course and took the course within the same university.

This study uses interpretative phenomenological analysis (IPA) to explore how participants understand and reflect on their lived experiences. Rather than stopping at description, IPA seeks to highlight participants' perspectives while also interpreting the significance of their accounts (Larkin et al., 2006). The approach combines three elements: phenomenology, hermeneutics, and idiography. Phenomenology guides the focus on participant's shared experiences, in this case, how they navigate and persist through calculus. Hermeneutics introduces a double layer of interpretation. That is, participants work to make sense of their own experiences, and the researcher then interprets those reflections. Idiography centers on detailed analysis of individual cases before drawing connections to broader patterns across participants.

My poster will present initial findings from eleven STEM, first-generation students who are reflecting on their calculus journey from their semi-structured interviews. I look forward to sharing my study with the RUME community and gathering feedback on how to conceptualize their calculus journey in relation to challenges and assets.

References

Ardoin, S. (2017). *College aspirations and access in working-class rural communities: The mixed signals, challenges, and new language first-generation students encounter*. Lexington Books.

Bressoud, D. M., Carlson, M. P., Mesa, V., & Rasmussen, C. (2013). The calculus student: insights from the Mathematical Association of America national study. *International Journal of Mathematical Education in Science and Technology, 44*(5), 685-698.

Chen, X., & Carroll, C. D. (2005). First-Generation Students in Postsecondary Education: A Look at Their College Transcripts. Postsecondary Education Descriptive Analysis Report. NCES 2005-171. *National Center for Education Statistics*.

Covarrubias, R., Valle, I., Laiduc, G., & Azmitia, M. (2019). "You never become fully independent": Family roles and independence in first-generation college students. *Journal of Adolescent Research, 34*(4), 381-410.

Gutiérrez, R. (2008). Research commentary: A gap-gazing fetish in mathematics education? Problematizing research on the achievement gap. *Journal for research in mathematics education*, *39*(4), 357-364.

Larkin, M., Watts, S., & Clifton, E. (2006). Giving voice and making sense in interpretative phenomenological analysis. *Qualitative research in psychology*, *3*(2), 102-120.

Olson, S., & Riordan, D. G. (2012). Engage to excel: producing one million additional college graduates with degrees in science, technology, engineering, and mathematics. Report to the president. *Executive Office of the President*.

Rasmussen, C., & Ellis, J. (2013, July). Who is switching out of calculus and why. In Proceedings of the 37th Conference of the International Group for the Psychology of Mathematics Education (Vol. 4, pp. 73-80).