

An Intersectional, Quantitative Analysis of Undergraduate Students' Responses to Racialized and Gendered Instructional Events in Undergraduate Calculus

Megumi Asada
Rutgers University

Dan Battey
Rutgers University

Luis A. Leyva
Vanderbilt University

Maria Maria Castillo
Vanderbilt University

Keith Weber
Rutgers University

Keywords: Calculus; Equity; Black; Latin*; Women

It is widely agreed that undergraduate calculus is a gatekeeper to STEM degrees, weeding out Black and Latin* students and leading to a disproportionate loss of women (Ellis et al., 2016; Weston et al., 2019). Students' experiences in calculus classrooms can reveal how instruction reinforces inequities in mathematics learning opportunities (Leyva et al., 2021; Leyva, 2016). Our poster presents a quantitative analysis of the impact from two marginalizing events in calculus instruction on students' emotions and participation across race-gender intersections.

Previously, our team completed a qualitative study where cisgender Black students, Latin* students, and white women journaled about marginalizing instructional events in their calculus classrooms. Journaling responses were used to develop stimulus events for individual and group interviews to solicit student perceptions of these events as potentially racialized and/or gendered. We developed theoretical accounts for how seemingly neutral and commonplace events, such as ignoring a student's raised hand, can be marginalizing when accounting for broader influences of racism and misogyny (e.g., stereotypes of mathematical ability; Leyva et al., 2021). This work examines the extent to which our prior qualitative accounts generalize to a larger population.

The present quantitative study explores national survey data collected in Fall 2019 and Fall 2021 from students at 108 state colleges and universities with similar demographics to the state university where the qualitative study was conducted. Survey respondents included 322 Black, Latin*, American Indigenous, Middle Eastern and/or North African students, and multi-racial students. Our analysis focused on students' responses to two instructional events that our prior work identified as marginalizing (Leyva et al., 2021). The first event involves a student attempting to correct an instructor's mistake and getting interrupted by the instructor. The second event features an instructor laughing at a student and repeatedly not providing an answer to their question. For each event, our participants addressed if it would: (i) make them feel angry, frustrated or discouraged, (ii) impact their future participation, and (iii) make them aware of their race or gender. A factor analysis based on participants' responses to items in categories (i) and (ii) identified two scales. We report average scores on a scale ($\alpha=0.890$) accounting for negative affective and participatory impacts of each event.

Results and Significance

On average, Black women ($M=3.14$, $SD=0.60$; $M=3.08$, $SD=0.69$) and white gender nonconforming students ($M=3.11$, $SD=0.47$; $M=3.33$, $SD=0.36$) were negatively affected by both events. (An average score of 3 corresponds to choosing "agree" to items indicating negative impacts on a 5-point Likert scale). Latin* women, white women, and Black men averaged above a 3 for one event. The results speak to the differential impact of instructional events by race-gender intersection and can help us create more affirming classroom spaces for historically marginalized students.

References

- Ellis, J., Fosdick, B., & Rasmussen, C. (2016). Women 1.5 times more likely to leave STEM pipeline after calculus compared to men: Lack of mathematical confidence a potential culprit. *PLOS One*, 11(7).
- Leyva, L., Quea, R., Weber, K., Battey, D., & López, D. (2021). Detailing racialized and gendered mechanisms of pre-calculus and calculus classroom instruction. *Cognition & Instruction*, 39(1), 1-34. DOI: 10.1080/07370008.2020.1849218
- Leyva, L. A. (2016). An intersectional analysis of Latin@ college women's counter stories in mathematics. *Journal of Urban Mathematics Education*, 9(2), 81–121.
- Weston, T. J., Seymour, E., Koch, A. K., & Drake, B. M. (2019). Weed-out classes and their consequences. In A. Hunter & Seymour (Eds.), *Talking about leaving revisited: Persistence, relocation and loss in undergraduate STEM education*. Springer.