Improvement in Undergraduate Student Survey Responses About Engaging and Belonging in ELITE PD MGTAs' Mathematics Courses

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Research on teaching practices in post-secondary mathematics classrooms consistently show that students benefit from engaging, active learning environments (Harper & Quaye, 2009; Laursen, 2013; Laursen et al., 2014; Laursen & Rasmussen, 2019; PCAST, 2012; Wieman, 2017). However, such benefits are not necessarily possible for all students unless those active learning environments also foster a sense of belonging (Brown, 2018; Ernest et al., 2019; Johnson et al., 2020; Voigt et al., 2023). Given that mathematics graduate teaching assistants (MGTAs) teach a significant number of undergraduate students over the course of their graduate studies (Selinski & Milbourne, 2015), it is important for MGTAs to develop teaching practices that engage students and increase their sense of belonging.

Our research team implemented a three-year PD program (ELITE PD) for MGTAs that is focused on teaching practices that support each and every student to meaningfully engage in learning mathematics, especially through group work. The goal of this poster is to share results from our analysis of undergraduate student survey responses from the mathematics classes of MGTAs enrolled in ELITE PD. Our research question is: *Do MGTAs receive improved student survey responses over time in the ELITE PD program, specifically from Winter to Spring during the 2023-24 and 2024-25 academic years?*

We focused our analysis on one cohort of 12 MGTAs who were new to teaching in 2023-24 and who completed two years of ELITE PD during their first two years of the mathematics graduate program. The MGTAs experienced a three-day, pre-fall term orientation and graduate teaching seminar in their first year. During fall and winter of their second year, they participated in seminars that emphasized active learning and student engagement through exploration and discussion of numerous evidence-based teaching practices. As part of our study, we surveyed the MGTAs' students during each term to see whether we saw improvement in students' responses to the MGTAs' teaching. We collected over 1000 responses for this cohort over this time period.

We conducted two statistical analyses by comparing means and standard deviations of survey responses for our cohort of 12 MGTAs from winter to spring: (1) in 2024 (2) and in 2025. Wilcoxon Signed Ranks Tests revealed significant differences (at $p=.05$ and $p=.10$) in means and standard deviations for a number of Likert-scale items (ranked from Strongly Disagree (1) to Strongly Agree (5)) in 2024 and 2025. For example, in 2024 the mean scores across all 15 items increased from 4.04 in winter to 4.15 in spring, and statistically significant differences in means (at $p=.05$) were found for four survey items. Two such items included: *I felt welcomed, comfortable, and a sense of belonging in this course*; *This course was structured so that I could work effectively with others who were different from me.* We also found statistically significant differences in means (at $p=.05$) for two survey items in 2025: *I felt safe contributing my ideas in class discussions*; *My TA presented examples that resonated with me or related to my interests.*

For our poster, we present our statistical results in more detail, discuss their implications, and future analyses. Primarily, these results demonstrate the promise of professional development for MGTAs to improve all students' engagement and sense of belonging in mathematics classrooms.

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References

Brown, S. (2018). E-IBL: An Exploration of Theoretical Relationships Between Equity-Oriented Instruction and Inquiry-based Learning. In (Eds.), A. Weinberg, C. Rasmussen, J. Rabin, M. Wawro, & S. Brown, *Proceedings of the 21st Annual Conference on Research in Undergraduate Mathematics Education* (pp. 1-15), San Diego, California.

Ernest, J. B., Reinholz, D. L., & Shah N. (2019). Hidden competence: Women's mathematical participation in public and private classroom spaces. *Educational Studies in Mathematics, 102*(2), 153-172. https://doi.org/10.1007/s10649-019-09910-w.

Harper, S. R., & Quaye, S. J. (2009). *Student engagement in higher education: Theoretical perspectives and practical approaches for diverse populations*. Routledge.

Johnson, E., Andrews-Larson, C., Keene, K., Melhuish, K., Keller, R., & Fortune, N. (2020). Inquiry and gender inequity in the undergraduate mathematics classroom. *Journal for Research in Mathematics Education, 51*(4), 504–516. https://doi.org/10.5951/jresematheduc-2020-0043.

Laursen, S. L. (2013). From innovation to implementation: Multi-institution pedagogical reform in undergraduate mathematics. In D. King, B. Loch, & L. Rylands (Eds.), *Proceedings of the 9th DELTA conference on the teaching and learning of undergraduate mathematics and statistics*, Kiama, New South Wales, Australia, 24-29 November 2013. Sydney: University of Western Sydney, School of Computing, Engineering and Mathematics, on behalf of the International Delta Steering Committee.

Laursen, S. L., Hassi, M. L., Kogan, M., & Weston, T. J. (2014). Benefits for women and men of inquiry-based learning in college mathematics: A multi-institution study. *Journal for Research in Mathematics Education*, *45*(4), 406-418.

Laursen, S. L., & Rasmussen, C. (2019). I on the prize: Inquiry approaches in undergraduate mathematics. *International Journal of Research in Undergraduate Mathematics Education*, *5*, 129-146.

President's Council of Advisors on Science and Technology (PCAST). (2012). *Engage to excel: Producing one million additional college graduates with Degrees in Science, Technology, Engineering, and Mathematics*. Washington, DC: The White House.

Selinski, N. E., & Milbourne, H. (2015). The institutional context. In D. Bressoud, V. Mesa, & C. Rasmussen (Eds.), *Insights and recommendations from the MAA national study of College Calculus* (pp. 31-44). Washington, DC: MAA Press.

Voigt, M., Hagman, J. E., Gehrtz, J., Ratliff, B., Alexander, N., & Levy, R. (2023). *Justice through the lens of calculus: Framing new possibilities for diversity, equity, and inclusion.* MAA Press. https://doi.org/10.48550/arXiv.2111.11486.

Wieman, C. (2017). *Improving how universities teach science*: *Lessons from the Science Education Initiative*. Cambridge, MA: Harvard University Press.