

STUDENTS' ENGAGEMENT WITH THE SCIENCE AND ENGINEERING INTEGRATED CALCULUS TASKS

Enes Akbuga
Texas State University
enes@txstate.edu

Calculus acts as a filter to the STEM pipeline, which blocks students' access to STEM careers (Steen, 1987). Therefore, a strong foundation and understanding of calculus concepts is an important requirement for all STEM degrees (Young et al., 2011). Students who are engaged during learning activities, achieve better grades and educational activities are positively related to academic performance (Kuh et al., 2008).

Schools should provide opportunities to learn about mathematics by working on problems arising in contexts outside of mathematics (NCTM, 2000). Literature shows tendency towards integrated science and mathematics education; however, more empirical research grounded in these theoretical models is clearly needed (Berlin & Lee, 2005). Therefore, this study aims to investigate the following question;

- How students engage with the Science and Engineering Integrated Calculus Tasks?

The Science and Engineering Integrated Calculus Tasks refers to the calculus tasks that are science and engineering related in nature. Since this study was a small-scale study for those tasks, physics and computer science tasks were selected and piloted. Participants were students who were enrolled to calculus courses at a Southwestern university in the U.S. Data come from task-based interviews involving the participants working on the tasks.

Strong evidence showed that the tasks supported the participants in connecting physics and science to calculus. One participant states that:

It's to me it's coming up, its creating and designing a solution to something that could be a real-world problem and so I think that I think that adds more to the experience. It certainly gives a lot. Like I feel like I am doing something I feel like I am not just doing a bunch of math you know?"

Evidence shows that the tasks were interesting and enjoyable for the participants and that they felt motivated through this experience. This finding suggests that interdisciplinary approaches might increase students' engagement and thus contribute to positive learning experiences with calculus.

References

- Berlin, D. F., & Lee, H. (2005). Integrating Science and Mathematics Education: Historical Analysis. *School Science and Mathematics, 105*(1), 15-24.
- Kuh, G. D., Cruce, T. M., Shoup, R., Kinzie, J., & Gonyea, R. M. (2008, October). Unmasking the effects of student engagement on first-year college grades and persistence. *The Journal of Higher Education, 79*(5).
- National Council of Teachers of Mathematics. (2000). *Principles and Standards for School Mathematics*. Reston, VA, United States of America.
- Steen, L. (1987). *Calculus for a new century: A pump not a filter*. Mathematical Association of America, MAA Notes (8).
- Young, C. Y., Georgiopoulos, M., Hagen, S. C., Geiger, C. L., Dagley-Falls, M. A., Islas, A. L., . . . Bradbury, E. E. (2011). Improving student learning in calculus through applications. *International Journal of Mathematical Education in Science and Technology, 42*, 591-604.