Where and to Whom Should Students Talk About Math: Mathematicians' Contemplations of Student-Instructor and Student-Student Interactions

Lindy Hearne
Virginia Tech

Keywords: Active learning; changing pedagogical practice; linear algebra; university mathematics instruction

Aims

In this poster, we focus on discussion or communal problems-solving to promote higher-order thinking, aiming to identify where instructors are open to employing instructor-student and student-student interaction in teaching and learning of abstract linear algebra.

Literature review

Despite effective alternative research-based practices showing positive effects on student learning outcome (see Freeman et al., 2014), most university mathematics courses are taught predominantly by lecture (Fukawa-Connelly et al., 2017; Johnson et al., 2018; Johnson, 2019). In response, Artigue (2016) recommends "collaborative projects, building and negotiating, jointly with mathematicians … [finding approaches] … that make sense for all … and meet their respective … needs" (p. 12). As proposed changes to instructional practices occur in environments where there are obligations to mathematics as a discipline, to students, and to their institutions (Charzan et al., 2016), considering adoption of active learning strategies involve managing sometimes-conflicting obligations.

Methods

We utilize data from a collaborative project between mathematics education researchers and mathematicians where together they attempted to integrate active learning pedagogy into mathematicians' lectures in a proof-based linear algebra course. We used the method of constant comparison through the grounded theory approach (Strauss and Corbin, 1994) to form a preliminary codebook using Atlas.ti software. Next, we focused on the interactions where instructors were considering in class and out of class activities. The table of code was further developed to code the instructors' responses to active learning strategies which focused on two different interlocutor pairs, namely student-student and student-instructor.

Preliminary Results and Discussion

We found instructors cited time and student preference as the two major constraints to implementing discussion in the classroom. Overall, the participating instructors were more open to student-instructor interaction (coded 119 times) than student-student interaction (coded 21 times), though not in all cases (12 student-student coded by a single instructor, who had facilitated active learning as a graduate student).

Outside of class activities were raised as an alternative, by the instructors when discussing both time, and student preference obligations that constrained their use discussion in the classroom. In these cases, 7 were coded student-instructor interactions and 5 were coded student-student interactions. Outside of class discussion activities overcame the in-class time constraint and were viewed as beneficial. Furthermore, they were student initiated, and so respected and encouraged student autonomy.

Acknowledgments

This research was supported by National Science Foundation award number 481220.

References

Artigue, M. (2016). Mathematics Education Research at University Level: Achievements and Challenges. First conference of International Network for Didactic Research in University Mathematics, March 2016, Montpellier, France.

Chazan, D., Herbst, P., & Clark, L. (2016). Research on the teaching of mathematics: A call to theorize the role of society and schooling in mathematics instruction. In D. Gitomer & C. Bell (Eds.) *Handbook of research on teaching*, *5*, 1039-1097. American Education Research Association.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the national academy of sciences*, *111*(23), 8410-8415.

Fukawa-Connelly, T., Weber, K., & Mejía-Ramos, J. P. (2017). Informal content and student note-taking in advanced mathematics classes. *Journal for Research in Mathematics Education*, *48*(5), 567-579.

Johnson, E. (2019). Chapter 6. Undergraduate mathematics instruction: Not as bad as you'd think? S. Laursen & B. Ruedi (Eds.), *Levers for change: An assessment of progress on changing STEM instruction*. American Association for the Advancement of Science. Washington, DC.

Johnson, E., Keller, R. & Fukawa-Connelly, T. (2018). Results from a national survey of abstract algebra instructors: Understanding the choice to (not) lecture. *International Journal for Research in Undergraduate Mathematics Education. 4(2),* 254-285.

Strauss, A., & Corbin, J. (1994). Grounded theory methodology: An overview. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 273 – 285). Thousand Oaks: Sage Publications.