

## Faculty Collaboration and its Impact on Instructional Practice in Undergraduate Mathematics

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*To reform instruction by moving towards student-centered approaches, research has shown that faculty need and could benefit from support and collaboration (Henderson, Beach, & Finkelstein, 2011; Speer & Wagner, 2009). In this qualitative instrumental case study I examine the ways in which a mathematician's instruction developed during his participation in a faculty collaboration geared towards reforming instruction and aligning it with inquiry oriented instruction (Kuster, Johnson, Keene, & Andrews-Larson, 2017; Rasmussen & Kwon, 2007). Preliminary results indicate ways in which student thinking was used as a discussion point in the faculty collaboration connected to the ways in which student thinking was used in the classroom to advance the mathematical agenda. Further, results indicate that the mathematical beliefs of the mathematician sometimes took precedence over the use of student work in the classroom.*

*Keywords:* faculty collaboration, instructional practice, differential equations

Research has shown that mathematicians may struggle implementing a new curriculum without support (Speer & Wagner, 2009; Wagner, Speer, & Rossa, 2007). Further, research has shown how summer workshops and online forums aid mathematicians in sustaining instructional change (Hayward, Kogan, & Laursen, 2015). Research is underway that explores diverse ways to engage mathematicians and support them in reaching their goal for instructional change (e.g., online video calls). This study focuses on one participant of an ongoing project to support mathematicians' instructional change, Dr. DM, and seeks to find links between his experiences in the online faculty collaboration and his instructional practice. The poster will address the following research question: How does one mathematician's instructional practice develop while participating in a faculty collaboration for inquiry-oriented differential equations (IODE)?

### **Methods and Preliminary Results**

Data for this case study comes from observations of the faculty collaboration online meetings, Dr. DM's classroom observations, and audio recordings of three interviews. Analysis of the classroom instruction uses the inquiry oriented instructional framework (Kuster et al., 2017) while analysis of the faculty collaboration and interviews uses a priori coding from our previous work (Keene, Fortune, & Hall, under review) as well as research on the roles of speakers and listeners in mathematics (Krummheuer, 2007, 2011).

Analysis is ongoing but preliminary results seem to indicate that Dr. DM's implementation of the IODE materials was influenced by his participation in the faculty collaboration. During the semester-long faculty collaboration Dr. DM shifts from discussing his students' thinking to evaluating and anticipating it. When that shift occurred, Dr. DM also shifted the way in which he used his students' thinking to advance the mathematical agenda. This use of student thinking, however, was stifled by his own mathematical beliefs when the content of the course aligned with his research agenda. While it is desirable for faculty to be passionate about their research and integrate it into their teaching for authentic learning experiences, in this case, it was sometimes at odds with the students thinking at given moments in the class. Further work will describe the connections and offer ideas to other facilitators of faculty online instructional support groups.

## References

- Hayward, C. N., Kogan, M., & Laursen, S. L. (2015). Facilitating instructor adoption of inquiry-based learning in college mathematics. *International Journal of Research in Undergraduate Mathematics Education*, 2(1), 59–82.
- Henderson, C., Beach, A., & Finkelstein, N. (2011). Facilitating change in undergraduate STEM instructional practices: An analytic review of the literature. *Journal of Research in Science Teaching*, 48(8), 952–984.
- Krummheuer, G. (2007). Argumentation and participation in the primary mathematics classroom: Two episodes and related theoretical abductions. *Journal of Mathematical Behavior*, 26(1), 60–82. <http://doi.org/10.1016/j.jmathb.2007.02.001>
- Krummheuer, G. (2011). Representation of the notion “learning-as-participation” in everyday situations of mathematics classes. *ZDM - International Journal on Mathematics Education*, 43(1), 81–90. <http://doi.org/10.1007/s11858-010-0294-1>
- Kuster, G., Johnson, E., Keene, K. A., & Andrews-Larson, C. (2017). Inquiry-oriented instruction: A conceptualization of the instructional principles. *PRIMUS: Problems, Resources, and Issues in Mathematics Undergraduate Studies*, 1–18. <http://doi.org/10.1080/10511970.2017.1338807>
- Rasmussen, C., & Kwon, O. N. (2007). An inquiry-oriented approach to undergraduate mathematics. *Journal of Mathematical Behavior*, 26(3), 189–194.
- Speer, N. M., & Wagner, J. F. (2009). Knowledge needed by a teacher to provide analytic scaffolding during undergraduate mathematics classroom discussions. *Journal for Research in Mathematics Education*, 40(5), 530–562. <http://doi.org/10.2307/40539355>
- Wagner, J. F., Speer, N. M., & Rossa, B. (2007). Beyond mathematical content knowledge: A mathematician’s knowledge needed for teaching an inquiry-oriented differential equations course. *Journal of Mathematical Behavior*, 26(3), 247–266. <http://doi.org/10.1016/j.jmathb.2007.09.002>