Towards an Awareness of Instructional Approaches in Graduate Mathematics

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Mathematics teaching and learning research has occurred in elementary through secondary levels for at least the past century (Perry, 1901). Researchers have debated what mathematics should be taught (Romberg, 1992; Apple, 1992; McLeod et al., 1996), how content should be taught (National Research Council, 2001; Gutstein, 2016), and even who deserves to learn math (Guttiérrez, 2018; Schoenfeld, 2002; Louie, 2017). We have learned many things from these studies such as different perceptions of mathematics learning (Nasir, 2002; Sfard, 1998), and benefits of teaching strategies that center student participation (Boaler & Greeno, 2000). Recently, there have been efforts to research undergraduate math, namely the calculus sequence, abstract algebra, and linear algebra (Kogan & Laursen, 2014; Abdulwahed et al., 2012). These efforts have had impacts on how some universities (re-)structure their math courses and have resulted in greater student success in these courses (Laursen et al., 2014). All of these results came from investigating mathematics at various levels of a learner's trajectory, but there exists a higher level of tertiary mathematics where little research exists: graduate mathematics courses.

In many PhD mathematics programs across the United States, there is a common course trajectory for students. This trajectory involves a pillar sequence of classes, typically in Algebra, Analysis, and Topology. These courses are assessed using department-created tests, which the institution of study called preliminary exams, that are designed to evaluate student understanding of the concepts related to these core courses. Different schools have different expectations for the quantity/time frame for tests and testing windows and what are considered pillar courses. Overall, the trend for many students going into a mathematics PhD programs in the United States is to take course sequences that have high stakes assessment and then the courses beyond these are evaluated by instructor discretion.

This poster shows student/instructor responses about instructional practices during different stages of a students PhD program. Research has shared very little about course sequencing in graduate programs nor how this sequencing relates to student/instructor experiences in the classroom. Through interviews with PhD students and instructors of graduate mathematics courses, as well as classroom observations in multiple courses through the program at one PhD granting midwest university, I have had the opportunity to discuss teaching strategies and observe graduate classes in action. One finding from these data shows the difference in assessment strategies used and also instructional practices. For example, one student participant explained how"the pillar courses and the after pillar courses are very different", specifically pointing to her experience in a non pillar Analysis class where the instructor would "lecture at us [students] for a couple of days, asking us for our input [and] we got to ask questions and direct the lecture, depending upon our understanding." This contrasts with her pillar experience where, "There's no active learning. There's no group work. There's no discussions really happening in class for certain instructors." This shows one example of different teaching styles that are used.

Discussing differences between classroom instruction can begin conversations about mathematical achievement in PhD programs. Who benefits/struggles from the different instructional styles? How do the different approaches to teaching impact student retention? These questions and more are very important to consider when looking at classroom practices.

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