Exploring Mathematics Graduate Teaching Assistants’ Developmental Stages for Teaching

Mary Beisiegel
Oregon State University

Traditional training programs that address mathematics graduate teaching assistants’ (MGTAs) teaching practices are offered when they first arrive to campus, when they have little, if any, teaching experience. However, not much research has investigated how MGTAs’ thinking about and facility with teaching change over the course of their graduate programs and, consequently, how their need for training changes over time. The goal of this study is to understand MGTAs’ developmental stages for teaching and how understanding these stages can inform the creation of a multi-year training program. Eleven MGTAs from a large, doctoral granting institution were surveyed and interviewed over the course of an academic year. Survey and interview responses were examined using a specific model of teacher development. Preliminary analyses, suggestions for multi-year MGTA training programs, and questions for future research are discussed.

Keywords: Graduate Teaching Assistants, Professional Development, Training for Teaching

Background

Years of research have provided evidence that the form of instruction in science, technology, engineering, and mathematics (STEM) disciplines in post-secondary institutions is significantly problematic for undergraduate learners. In particular, Seymour and Hewitt (1997) found that undergraduates in STEM courses were most likely to point to poor pedagogy as the reason for dropping out of a STEM discipline. More recently, researchers have found that students in traditional lectures have higher failure rates than students in classrooms that support active learning and student engagement in mathematical work (Chen, 2013; Freeman et al., 2014; PCAST, 2012). Mathematics instructors’ and professors’ teaching practices have an impact on students, as do graduate teaching assistants, with undergraduate students’ interest in a subject experiencing a greater decline when they are taught by a graduate teaching assistant (Bettinger & Long, 2004).

As a result of these findings and the understanding that mathematics graduate teaching assistants (MGTAs) represent the future instructors and professors of mathematics, researchers have investigated the teaching practices of MGTAs (Belnap, 2005; Latulippe, 2007; McGivney-Burrelle, DeFranco, Vinsonhaler, & Santucci, 2001; Speer, 2001). In particular, researchers have developed courses and other training programs with the goal of providing MGTAs with a new vision of instruction that would offer undergraduate learners more meaningful ways of engaging in mathematics that lecture-based, direct-instruction does not provide (DeFranco & McGivney-Burrelle, 2001; Harris, Froman, & Surles, 2009; Speer, 2001). However, these studies found that MGTAs’ instructional practices did not change as a result of these programs. Despite investigations of the efficacy of training programs, the field of MGTA professional development has not yet reached a consensus on the breadth and scope of training programs for MGTAs, with training programs varying from a few hours, to an intensive week, to training incrementally spread over the course of an academic term (Deshler, Hauk, & Speer, 2015; Harris et al., 2009; McGivney-Burrelle et al., 2001).

Of particular note about MGTA training programs, however, is that most are implemented solely in MGTAs’ first year of graduate school; more specifically, when MGTAs first arrive to their programs, when they know little about teaching and likely have not had experience teaching. This is
of concern because, over the course of their graduate programs, MGTAs’ knowledge of teaching and mathematics will change significantly. Yet, in general, MGTAs will not have explicit attention paid to the development of their teaching practices as their knowledge and beliefs change, and as they encounter particular obstacles to instructional change and innovation. Such obstacles include MGTAs’ own histories as mathematics learners (Deshler et al., 2015), the social context of the department (DeFranco & McGivney-Burrelle, 2001), belief among faculty members that attention to teaching is a distraction from research (Harris et al., 2009), and the structures of teaching assistant work (Beisiegel & Simmt, 2012).

Little is known about how MGTAs develop their teaching practices over the course of their graduate programs, even though their teaching practices have a significant, negative impact on undergraduate learners (Bettinger & Long, 2004). Researchers have pointed to the development of MGTA training programs as needing to be informed by many factors and should take into account such needs of the graduate students at different stages of their development (Park, 2004). Additionally, DeFranco and McGivney-Burrelle (2001) note that such training programs should be “viewed as ongoing professional development experiences that support [MGTAs] through the long and complex process of changing their teaching practices” (p. 688). With this in mind, the purpose of the study is to understand MGTAs’ transitions, possible stages and changes in their thinking about teaching and learning as they progress through their programs. The research questions that guide this study are:

1. Do MGTAs go through developmental stages as teachers over the course of their graduate programs?
2. What implications do these stages have for how MGTAs are trained and supported over the course of their graduate programs?

The long-term goal of this study is to use this new knowledge to create a well-informed, scaffolded training program that will attend to the stages MGTAs go through as their teaching and thoughts about teaching evolve.

**Theoretical Framework**

Besides what has been learned through the study of training programs that address MGTAs’ teaching practices, little is known about what stages MGTAs go through and how they can be supported as their views of teaching and learning evolve over the two to six years they are in a graduate program. Looking to the K-12 literature, researchers have studied schoolteachers’ experiences in order to gain an understanding of teachers’ transitions over time. For instance, Katz (1972) described four developmental stages, which include: (1) *survival* of the first year of teaching, with particular focus on classroom management and the routines of classrooms and schools; (2) *consolidation*, in which teachers begin to understand which skills they have mastered, and what tasks they still need to master; (3) a period of *renewal*, when teachers become tired of their routines and start to think of how things might happen differently; and (4) reaching *maturity*, where teachers think more broadly about the contexts of schools and students’ learning (p. 52-53). Importantly, Katz (1972) notes that the third stage of renewal, of beginning to question standard teaching practices, does not begin until the third or fourth year of teaching. If MGTAs experience similar developmental stages, then the current programs that address their teaching practices only at the beginning of their graduate programs are likely inadequate and more thought should be given to MGTAs’ possible developmental stages and their needs at those stages.
Context of the Study

In order to understand the MGTAs’ transitions in teaching over time, two beginning-of-the-academic-year surveys were developed, one for new and one for experienced MGTAs. Additionally, protocols for mid-year and end-of-year interviews were created. Surveys are used at the beginning of the year because of logistical issues, such as varied arrival times to campus, and to also capture baseline information. The surveys include open-ended questions that inquire about MGTAs’ thoughts about teaching and learning mathematics, how they would describe a well-taught mathematics lesson, and what had influenced the way they think about teaching. Additionally, Likert-Scale items include those that address MGTAs’ epistemic beliefs and self-efficacy. Mid- and end-of-year interviews allow a deeper view their teaching practices, MGTAs’ most recent teaching experiences, whether they feel that they are receiving adequate support, and what other support they feel they need. The intention of the study is to survey and interview participants for the duration of their graduate programs in order to capture, longitudinally, any changes to their views of teaching and their need of support for teaching.

In 2015, the MGTAs were recruited from a department of mathematics in a large, doctoral granting institution. Approximately 5,000 students enroll in a lower-division mathematics course (such as Pre-calculus, Differential, Integral or Vector Calculus, Business Calculus, or Differential Equations) each year at this university, with the structure of most courses having three hours of lecture with 150-250 students per class and taught by an instructor. MGTAs are generally assigned to run recitations (1 hour workshops) of smaller groups of students from the large lecture sections. MGTAs are not assigned to courses based on knowledge, skill, or experience. Rather, assignments to courses depend mostly upon scheduling, although MGTAs are asked what their preferences are. At the beginning of the academic year, newly arrived MGTAs receive 2 ½ days of training for their teaching assignment, with a primary focus on how to support active learning and student engagement in mathematical work during recitations and lectures. During the summer after their first year, MGTAs are offered the opportunity to teach their own course as the instructor of record. Only informal mentoring happens before and during the summer sessions.

Eleven of 60 MGTAs agreed to participate in the first year of the study. Participants include 3 first-year, 2 second-year, 4 third-year, 1 fourth-year, and 1 fifth-year MGTA. At the time of submitting this proposal, each of the participants had completed the beginning-of-the-year survey as well as the mid-year and end-of-year interviews. The participants who remain in the mathematics graduate program will complete surveys and interviews in the upcoming academic year and new participants will be recruited. Participants’ responses to survey and interview questions were analyzed using thematic analysis (Braun & Clarke, 2006), with a deductive approach that looked for instances of the participants’ experiences that could be elucidated with Katz’s (1972) four-stage model of teacher development. At the end of the first year of this study, data has not yet been collected that would illustrate each participant’s transitions during the course of their programs. However, comparisons will be made between the first- and later-year MGTAs in order to gain a preliminary understanding of their developmental stages.

Preliminary Findings

The first year MGTAs alluded to surviving the first year as teaching assistants. For example, one first year MGTA described her initial experience teaching in this way: “The first [term], I was completely on my own and I didn't know what I was doing.” In this statement, I see that, despite the training the MGTA had received, she was still fairly uncertain about her teaching. The newness of
teaching was a disorienting and isolating, and she did not seem to rely on what she had heard or learned during her training. As another example, a first year MGTA stated this about his first term:

By that point the quarter was just getting really hectic and I wasn’t able to plan as much as I usually like to plan for courses. Sometimes I was looking at the material for about two hours before I started that day whereas usually I like to look at it the day before or during the weekend or something. And so sometimes, though, the classes that I went to where I was kind of doing it on the fly, where I was literally looking at it like an hour or two before class. A lot of times it’s just more like get the notes done, go in, and do it.

In this participant’s statement, I observe that the busy life of a new mathematics graduate student was enough to counteract the training that he had received when he first arrived. He noted that he had intended to devote more time to preparing for teaching, even creating revised drafts of lessons, with the aim of posing several open-ended questions during class. However, under the time constraints of his life as a graduate student, he switched to survival mode, with a routine of going through notes and presenting material and not implementing teaching strategies that would promote active learning.

One first-year MGTA spoke about his experience of being assigned to teach a course during the summer term at the end of his first year in the graduate program:

“I’ve never taught a day in my life – and when I went to – I originally just asked [two instructors] three questions. I asked them, “What worked in your classroom and what didn't?” “What advice do you have?” and some other questions. And so they answered that and then they said, “Hey, if you want to sit down and talk, we can.” And, if that hadn't happened – that was out of their own kindness – and, if that hadn't happened, I feel like I'd be drowning right now because I wouldn't know what to do.

This MGTA noted that he would not be surviving, but would instead be drowning, in his first teaching experience had he not independently sought out advice and course materials from instructors. Another interesting thing to note is his statement that he had “never taught a day in his life.” He had led multiple recitations during the two terms immediately prior to teaching his own course, and yet neither that experience nor the initial training seemed to provide him with enough resources to feel comfortable in his role as an instructor.

Later-year MGTAAs spoke differently about their teaching experiences. For example, one third-year MGTA summarized her transition from the survival stage to the renewal stage:

“I think previously, I was more focusing on, “I just want to survive my first teaching experiences.” So, now that this is my fourth time teaching, I feel a little bit more comfortable trying to incorporate more active learning in my classroom, and trying non-traditional techniques whereas previously, when I taught, for example, my first time teaching my own class and I taught Calculus, I did mostly lecture because I just wanted to do what I felt most comfortable with – what I felt I could be successful at.

From her statement it is not clear that she had tired of her routine of lecturing, as suggested by Katz (1972), for the transition from survival to renewal. Yet, it is clear that she is now comfortable enough in the classroom that she is beginning to think of what she might do differently; in this case, incorporate active learning. This is interesting as the MGTA training she had received three years prior had promoted active learning and it was only at the end of her third year that she was ready to consider and enact active learning strategies.

The third- and fourth-year participants’ statements illustrated their transition into maturity, as they were thinking more broadly of educational issues (Katz, 1972). For example, one MGTA noted that she had become more aware of different learning styles:
I’ve learned to understand more deeply some of the things students have going on in order for me to be more conscious of. I’ve also been very aware of different learning styles. I’m making sure to – some people are visual. I am visual. So I make sure to have everything written down. But I also know people are auditory learners. So I also read everything.

Another later-year MGTA spoke of her awareness of multiple choice assessment questions and potential biases within multiple choice questions, noting her observation that questions are “biased for gender and ethnicity and culture.” This particular MGTA had also begun to think about the intersection of teaching mathematics and social justice issues.

**Discussion**

Katz’s (1972) developmental stages are useful for defining and understanding the stages that MGTA go through. Through this framework, I observe that MGTA think about different, and progressively more sophisticated, aspects of instruction as they progress through their graduate programs and developmental stages. These findings suggest that MGTA are not necessarily ready to enact more demanding instruction (e.g., active learning) in their first experiences running recitations, when they are teaching for the first time and likely in survival mode. The findings of this study also suggest that MGTA have more advanced thoughts about teaching in their third and fourth years, thoughts that go beyond what is typically offered in initial MGTA training programs.

One conclusion is that MGTA training programs should be multi-year training programs that address these stages and the MGTA’s needs in each of these stages. A third-year MGTA illustrates how the initial training did not impact her at first and that follow-up training in her third year might be useful. Here she refers to the teaching strategies she had learned in her initial training:

I probably couldn’t recall them all, right? They’re just somewhere in the recess of my head. It might be good to hear them in the context of now having three years’ experience. And certainly what I thought was important before I had ever taught is going to be different than hearing it after three years’ experience. So maybe even if I heard the same thing, it would carry more weight now. I would have a better understanding for the context it would fit in.

Katz (1972) noted the stage of renewal, of thinking of how teaching might happen differently, does not being until a teachers’ third or fourth year in the classroom. Thus, with Katz’s finding and the participant’s statement, I suggest that training programs that extend into third and later years might gain more traction in helping MGTA enact more demanding forms of instruction, such as active learning. Once MGTA have more experience teaching, the instructional practices espoused by training programs can become more relevant, relatable, and practicable.

**Intended Questions for the Audience**

For the presentation at RUME, questions that I intend to pose and discuss with the audience are:

- Does Katz’s (1972) framework seem adequate for understanding and describing the developmental stages for MGTA?
- How might the results of this study be useful to and inform training programs for MGTA?
- What other questions and ideas should be answered in order to better inform the development of a multi-year MGTA training program?
References


