

The Ways Graduate Teaching Assistants Learn to Teach Through Various Professional Development Interactions

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Across the nation, there is increased national interest in improving the way mathematics departments prepare their GTAs. However, without an understanding of how GTAs interpret and make sense of various teaching practices, we are working without all of the information. I report preliminary results on the ways in which the understandings of GTAs of various teaching practices changed over a term. With this analysis, we will be able to better understand how to better support GTAs with their teaching in the future. The research presented here represents the start of an increased understanding of how GTAs form their own teaching practices.

Keywords: Graduate Teaching Assistants, professional development, teaching practices

Across the nation, many mathematics departments have begun to change the way they structure the teaching of the Calculus sequence based on the seven recommendations that emerged as a result of the MAA sponsored study of successful Calculus programs (Bressoud, Mesa, & Rasmussen, 2015). One of the recommendations was to improve the professional development (PD) offered to the Graduate Teaching Assistants (GTAs) involved in the teaching of Calculus. GTAs comprise a larger percentage of Calculus I instructors and teach a larger percentage of Calculus I students than tenure-track professors (Ellis, 2014), making their PD all the more important. Though these various mathematics departments have the common goal of improving the teaching practice of GTAs through PD, the structure of the PD programs for GTAs varies greatly among them (Belnap & Allred, 2009). Research on the PD programs across the nation is becoming more common place, as seen by the growth in the number of people in the PD working group at the annual Research in Undergraduate Mathematics Education conference.

Much of the research done on GTA PD programs have focused on the various structures of PD programs, on the outcomes of the programs, or on a small, in-depth case study (e.g., Kung & Speer, 2009). While it is important to know what the outcomes of the program are, it is equally important to understand how those changes occurred so as to improve our PD programs. In a review of the research, Speer, Gutmann, and Murphy (2005) stated the need for studies with longitudinal designs so as to “inform the design of exemplary programs that have a lasting influence on instructional practices” (p. 79).

The mathematics faculty at a large southwestern university made several changes to the calculus program, including to the structure of the PD program for the GTAs. The PD is oriented around supporting GTAs to teach in with a more student centered approach. As part of this program, the GTAs discuss effective teaching practices with each other, their course coordinators, and mathematics education researchers. This paper discusses preliminary results of analysis on the evolving understanding of effective teaching practices as evidenced in their discussions in the various formal meetings attended by the Calculus I and II GTAs. With a better understanding of the ways in which the discourse around various teaching practices evolve over time, we can better support GTAs in their learning to teach in the future.

Background

In many ways, professional development can feel like a complex game of telephone. The leaders and creators of the professional development have certain ideas of effective teaching practices that they are attempting to convey to the teachers or the facilitators with whom they are working. However, the facilitators and teachers are appropriately going to interpret it in their own way and share and use their transformed version of their ideas of effective practice. Research on the Standards movement reform of the 1980's and 1990's documented only a modest impact of the initiative on teachers' practice and that teachers selectively took up reform ideas and adopted only the surface-level features (Spillane & Zeuli, 1999). Researchers explained the adaptation in terms of teachers' learning processes and suggested that implementation varied because teachers drew on prior knowledge and practices when interpreting the message about the new standards and instructional practices (Coburn, Hill, & Spillane, 2016; Coburn, 2001; Cohen & Ball, 1990).

The similarity with the K-12 context is that when faculty and graduate students undertake reform teaching, all of those involved, including the department chair, course coordinators, faculty who take on the PD of teaching assistants, and the teaching assistants themselves, co-construct the message of the reform. It begins with a small group of faculty with the goal to promote high-quality instruction and its success ultimately, in large part, depends upon the learning of the teaching assistants who interact with the college students most frequently. My particular study focuses on how GTAs make sense of and interpret what they learn about how to lead a student-centered classroom.

There have been only a handful of studies done exclusively on the state of professional development of GTAs across the nation (Belnap & Allred, 2009; Ellis, 2015; Kalish et al., 2011; Palmer, 2011; Robinson, 2011). In addition to national level studies, there are also several case studies of particular programs at specific institutions, with a focus on the structure of or the efficacy of the program (e.g., Griffith, O'Loughlin, Kearns, Braun, & Heacock, 2010; Marbach-Ad, Shields, Kent, Higgins, & Thompson, 2010). So, while there have been studies that describe the various forms of PD or that give an idea of what GTAs have learned from their experiences in PD, little work has been done on the ways in which the GTAs have constructed their understandings of various teaching practices – “what teachers do and think daily, in class and out, as they perform their teaching work” (Speer, Smith, & Horvath, 2010, p. 99). This research contributes to understanding how the GTAs are appropriating and transforming various teaching practices to fit their own needs over time.

Setting

At the large, public southwestern university in this study, Calculus is taught in large lectures of approximately 160 students. The GTAs lead break-out sessions with approximately 35 students twice a week, with one meeting focused on active learning activities. To support the GTAs in facilitating these active learning activities, the GTAs participate in a three-day teaching seminar the week before classes begin in the Fall. The GTAs continue to meet approximately eight times throughout the term with mathematics education faculty. In addition to the formal PD, the GTAs have weekly meetings with their course coordinator where they talk about the activity for the following week and any additional administrative issues.

The structure of the GTA program has been changed to include a lead TA for each of Calculus I and II. The lead TA is a more experienced GTA who provides support to his or her fellow GTAs with a PD aspect that occurs both before the term begins and throughout the term (Ellis, 2015). Throughout the term, the lead TA visits the activity day sections of his or her

fellow GTAs to observe the class and meet with the GTAs afterward to debrief. The lead TA visits all of the other GTAs two or three times a term. A representation of all of these various meetings and observations throughout the term is given below in Figure 1.

Monday	Tuesday	Wednesday	Thursday	Friday
Meeting w/ Calc II Coordinator	Calc I Break-out sessions	Calc II Break-out sessions	Calc I Break-out sessions	PD Class w/ math ed researcher
Calc II Break-out sessions				Meeting w/ Calc I Coordinator

Figure 1: A sample week for GTAs from the Fall 2016 term.

Methods and Analysis

Sixteen GTAs agreed to be part of the study, including both of the lead TAs, seven new GTAs, and seven returning GTAs. I either audio or video-recorded each PD meeting, course coordinator meeting, debrief between the lead TA and a fellow GTA, and any break-out sections observed by the lead TAs. I transcribed each of the video and audio recordings and coded each utterance about teaching practices using descriptive coding (Bakhtin, Emerson, & Holquist, 1986; Miles & Huberman, 1994).

A theoretical perspective that includes both a social and a cognitive aspect is useful in making sense of the evolving nature of discussions around teaching practices. The socio-cultural learning theory put forth by Vygotsky posits learning occurs through a reflexive relationship between the individual and the community in which the individual interacts (John-Steiner & Mahn, 1996). In order to understand the ways in which the discussion evolved over time amongst the GTAs, I am using a modified version of a framework within the socio-cultural learning theory known as the Vygotsky space (Harré, 1983). With this framework, the understanding of a teaching practice can be tracked as it is appropriated and transformed by the GTAs throughout the term. A representation of the Vygotsky space can be seen below in Figure 2.

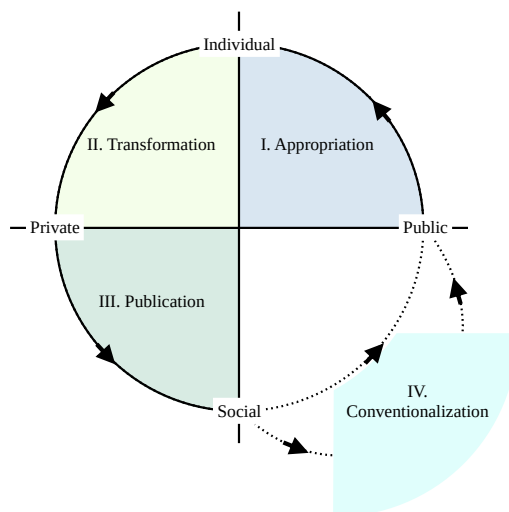


Figure 2: Modified diagram of the Vygotsky space.

Within this diagram, there are two axes: Public-Private and Individual-Social. These two axes make up four quadrants, which work to explain the four aspects of the Vygotsky space. For instance, *appropriation* is within the Public-Individual quadrant because it describes how an idea comes to a person from the public. *Transformation* is within the Individual-Private quadrant because it describes the way a person has made the original idea their own. In the third quadrant is *publication*, which is described as how the person makes their own private understanding of

the idea known to the social group they are within. At this point, the idea may go through several iterations of these three quadrants before it lands within the fourth quadrant, *conventionalization*, which represents that idea has become normalized within a community (Gallucci, DeVoogt Van Lare, Yoon, & Boatright, 2010).

The modified Vygotsky space framework facilitates our understanding of how changes occur within a community over time. In this study, it sheds light on how GTAs make sense of various teaching practices. Using this framework, a researcher attends to the speaker, the publicized interpretation, and the timing of the utterance, revealing how individuals may affect the community as well as how the community may affect the individual. An example of this sort of analysis is given in the preliminary results below.

Preliminary Results

One particular teaching practice that was discussed by the GTAs throughout the term was that of asking students to repeat or rephrase something that had just been said. This may be to repeat or rephrase something another student said, state a given task in their own words, or rephrase something the GTA has just explained. An experienced instructor in mathematics education introduced this teaching practice during the three-day seminar before the semester began:

“There was something that I wanted to add that I think is really productive [in] engaging your students in a task is to make sure that if someone gives an answer... and they're kind of going in the right direction, you want to make sure the rest of the class understands it as well so you can say ‘can somebody revoice what Nick just said or revoice what Joe just said’ or basically say what they said but in your own words to make sure that other students do understand...”

After this, several other references to this practice were made public by the professional development leaders, including as a way to reinforce an idea, to get students to interact with one another, to have the students state when they could not hear a response, and to make sure the students understand the task given to them.

Once the term began, a transformation in the way this teaching practice was discussed could be observed in the ways in which various GTAs made public their understanding:

“One of them is if you see someone who's talking, you say ‘hey can you repeat what, repeat what Christian said.’ And put them on the spot a little. But if they can't, don't make a big deal. They're already going to make a big deal about it.”

Independently of this interaction, the lead TA for Calculus I made a similar suggestion to one of his GTAs:

“And you had another student re-explain the directions which is always good because that means at least somebody is paying attention. Also, it makes them think oh what if he calls on me.”

As the term went on, the understanding of the teaching practice seemed almost become conventionalized around the thought that it was a good way to make sure students are paying attention in class. However, there was one more experienced GTA who continued to push her different version of a more “student-understanding” approach to the teaching practice amongst her peers:

“I think even asking [inaud] students to like revoice or talk about what just happened is good because it gives different perspectives than you teaching them and you make sure

someone in some group out there understands and maybe when they say it, others will get it better.”

When the term began to close, the student-understanding approach became more dominant in the ways GTAs discussed this teaching practice in formal settings, with the lead TA for Calculus I making public this transformed version after watching a fellow GTA’s teaching video:

“I think, um, one thing I do, 'cause I do the same thing. I ask them ‘do you understand that’ and then no one says anything so pick on someone you know, maybe not all the time, but occasionally pick someone you know usually struggles and see if they actually understand. Have them try and explain it. And then at that point they either do and they explain it, or they say ‘well, I don't actually get it.’ Okay well, take some time, talk about it with your groups and then we'll come back and then tell me what it means.”

While there is evidence to suggest the understanding of the teaching practice as useful in determining their students’ understandings was becoming conventionalized, the change only took place near the end of the term and so it cannot be said whether or not that understanding continued. What makes this particular example an interesting and important one to consider is the fact that the understanding of this teaching practice as a disciplinary tool may have been inadvertently encouraged by the professor of the professional development course.

Approximately one month into the term, the professor was engaging the GTAs in a discussion about what they noticed in a video they had just watched and said the following:

“If you use things like asking them to repeat what somebody else said, asking them to explain what somebody else said, those types of things, those can help get students to listen to each other.”

This could be interpreted as the professor suggesting this particular practice as a way to get students to engage with one another but since there was evidence of the GTAs understanding this practice as a disciplinary tool, I believe this could have been interpreted as something that would support such an understanding. So, without a good understanding of how the GTAs are making sense of various teaching practices, we may inadvertently encourage a belief that we ourselves may not believe.

Conclusion

Analysis for this study is currently on going but the preliminary results are proving to show some interesting conclusions. It is my belief that with the results from this study, we will have a better understanding of the ways in which graduate teaching assistants make sense of various teaching practices and therefore will be able to better support them in the future. Without taking into account the understandings and interpretations of the graduate students we are working to help, we may inadvertently enforce beliefs we do not hold our selves. With this information, the field can begin to understand how GTAs change their practice over time and improve the professional development offered to graduate students who are new to the practice of teaching.

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