Barriers and Drivers to Implementing GTA Professional Development focused on Active Learning, Equity, and Inclusivity

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Mathematics Graduate Teaching Assistants (MGTAs) play a significant role in undergraduate mathematics education, as they are often in a teaching-related position for courses in the College Algebra through Calculus II sequence. Further, research shows that teaching practices that promote active learning, equity, and inclusion lead to improved student outcomes (e.g., Freeman et al., 2014; Laursen & Rasmussen, 2019; Mulnix, Vandegrift, and Chaudhury, 2016). However, MGTA PD that reflects these practices may be limited due to a variety of reasons. In this manuscript we discuss barriers and drivers to implementing PD that reflects active learning and equity-focused values. The goal is to understand ways that we can utilize institutional-specific drivers and navigate barriers to support the implementation of more PD programs like the one in this study.

Keywords: Mathematics Graduate Teaching Assistant, Professional Development, Active Learning, Equity, Barrier

Mathematics graduate student professional development for teaching has become increasingly important in the Mathematics Education community. However, what that professional development looks like depends on local institutional contexts. A department's culture can impact what classroom practices graduate students implement as well as whether equity and inclusion are identified as being an important element for instruction. Department leaders who work closely with graduate students who have teaching roles, such as department chairs, course coordinators, and professional development providers, have an understanding of that culture and recognize existing barriers and drivers to implementing professional development for mathematics graduate teaching assistants (MGTAs).

The work presented here is part of a larger NSF-funded project focused on creating, implementing, and studying a multi-term professional development program for MGTAs across three different mathematics departments. The program titled, ELITE PD, has two primary foci: 1) active learning and 2) equity and inclusivity. However, how departments think about and approach these ideas can vary. Thus, we sought to understand institutional-specific barriers and drivers for implementing a MGTA professional development program focused on active, equitable, and inclusive teaching practices. Specifically, we ask: What barriers and drivers do department leaders identify for implementing an MGTA PD program focused on active learning, equity, and inclusivity?

Theoretical Frameworks

We sought to identify analytical frameworks that reflected the ELITE PD program foci. In the work by Shadle et al. (2017), researchers sought to understand STEM faculty perspectives with regard to shifting teaching practices from instructor-centered approaches to more student-centered approaches. Additionally, Harris and Wood have done extensive work in understanding barriers to advancing equity in instruction in higher education (e.g., The Community College Equity Assessment Lab (CCEAL), 2017; Harris & Wood, 2018; Wood & Harris, 2015). Together, the work of Shadle and colleagues and Harris and Wood provide us with

analytical frameworks that allow us to understand the barriers and drivers to implementing an MGTA PD program focused on active learning, equity, and inclusivity.

Shadle et al. (2017) examined STEM faculty response to a vision for teaching as proposed by university leadership. The vision proposed a shift towards student-centered instruction and leadership solicited input from faculty regarding the proposed vision, and faculty-perceived barriers and drivers toward this vision were then identified. Identifying barriers allowed leaders to better understand aspects and characteristics that might prevent change from occurring (e.g., university reward structures, individual beliefs) and drivers that could be leveraged to support change (e.g., collaboration in teaching, personal satisfaction). We drew upon Shadle et al.'s barriers and drivers as a starting point for our analytical framework for understanding barriers and drivers to implementing active learning in MGTAs' instruction.

While Shadle et al. (2017) address barriers and drivers associated with active learning and student-centered instruction, Harris and Wood (e.g., CCEAL, 2017; Harris & Wood, 2018; Wood & Harris, 2015) examine the barriers for doing equity-related work in higher education. Several of the barriers overlap with those identified by Shadle and colleagues. For example, both Shadel et al. and Harris and Wood highlight individual attitudes as playing a role in resistance to change efforts. Similarly, both groups of scholars emphasize institutional culture as potentially impacting change (e.g., institutional policies or processes). Harris and Wood additionally identify institutional "politics and power dynamics" as a potential barrier for equity-related work (2018, Barriers to Actually Achieving Equity section). Combined, both analytical frameworks provided us with a starting point for understanding department leadership perspectives on an MGTA PD program focused on active, equitable, and inclusive teaching practices.

Methods

A previous RUME paper with this project explored barriers and drivers tied to implementing an MGTA PD program focused on active learning, equity, and inclusivity (Fifty et al, 2022). That work examined a single institution through thematic analysis. Here we expand upon this work by looking across three institutions and implementing an a priori codebook built from the codes established by Shadle et al. (2017) and the work of Harris and Wood (e.g., CCEAL, 2017; Harris & Wood, 2018; Wood & Harris, 2015). We discuss our methods in the following sections. While we are building upon this work, this work is still preliminary, with only initial findings from coding being presented.

Data

ELITE PD is being implemented at three large, public universities: Beta University, Epsilon University, and Gamma University. Each university offers graduate programs in mathematics. Epsilon University primarily grants master's degrees in mathematics and Beta and Gamma Universities primarily grant PhD degrees in mathematics. At each institution there is a structure within the department around MGTA professional development and interviews were conducted with the leaders in these structures. Table 1 lists the titles of the leaders at each institution. In some cases, more than one person carried the same title, and those instances are documented by the number in parenthesis.

Table 1. MGTA Professional Development Leaders at each institution.

Epsilon University	Gamma University	Beta University
Incoming Dept Chair	Dept Chair	Dept Chair
Outgoing Dept Chair	Associate Chair	PhD Director
Course Coordinators (3)	Graduate Program	Course Coordinators (2)
PD Facilitators (1)	Chair	PD Facilitator
Graduate Advisor	PD Facilitator	

These interviews were semi-structured conversations around ELITE PD practices and implementation, which is described in more detail below. Interviews were conducted at the beginning of the study, before ELITE PD had been implemented at any of the institutions.

Coding

Analysis of these interviews was done through open coding. The initial codebook was taken from Shadle et al. (2017) and supplemented by the work done by Harris and Wood (e.g., CCEAL, 2017; Harris & Wood, 2018; Wood & Harris, 2015). As the interviews were coded, these codes were then refined, and other codes were added based on what was uncovered in the data. Codes were identified as being in one of three main categories: barrier, driver, or tension. Barriers were those codes that impeded ELITE PD practices, drivers supported ELITE PD practices, and tension codes were not necessarily barriers or drivers but emphasized local context or values that impacted ELITE PD practices. ELITE PD practices are:

- Active Engagement
- DEI practices in and out of the classroom
- Assessment (or feedback) of teaching practices aligned with active learning and/or DEI practices
- Faculty or peer MGTA mentoring practices
- Fostering MGTA autonomy/agency
- Awareness of and attending to power differentials (how MGTAs are treated, classroom practices, etc.)

Examples of barriers to ELITE PD practices include *Unclear Implementation* and *Student Resistance*, and *Improves Teaching and Assessment* is an example driver. Examples of tensions are *MGTA Workload* and *Student Preparedness*.

An utterance was coded only if it could be related to at least one of the ELITE PD practices listed above. If the utterance was not clearly related to one of those practices, it was not coded. For example, discussions around professional development for MGTAs were not coded unless it was clear that there was a connection to ELITE PD practices; general discussions about professional development were not coded.

Once a codebook had been formed, three researchers coded all of the interview. Each interview was coded by at least two researchers. For each interview, the researchers coded individually and then came together to discuss any differences in coding until there was 100% agreement.

Initial Findings

Some initial findings have included the most common barriers and drivers found across the three institutions. Each of these are described in more detail in the following sections.

Drivers

The three most common drivers were *Supportive Attitude*, *Current Practices*, and *Department Support*. A description of each of these codes is given in Table 2.

Table 2. Common drivers

Supportive Attitude	The interview participant expresses (personal) view in line with ELITE PD practices such as being supportive of efforts that align with ELITE PD values.
Current Practices	• Some MGTAs and/or faculty participate in PD that reflect ELITE PD practices • MGTAs and/or faculty member(s) have already adopted ELITE PD practices
Department Support	In reference to the department as a collective (use of "we") in relation to efforts associated with ELITE PD practices. May be part of department-wide culture, expectations, vision statement, and/or department mission.

The drivers described in Table 2 were found to be the most common among the three institutions, with *Supportive Attitude* being the most common driver across all three institutions. These drivers did not vary much between the three institutions. For all three institutions, these were the most commonly discussed drivers, which was not the case for barriers as described below. Other drivers included *Institutional Support* and *Aligns With Existing Resources*.

One limitation with this finding is that all three of these drivers are quite broad and encompass many different beliefs and ideas. We are currently working on a secondary code system for each of these drivers, as well as for *Institutional Support*, so as to gain a better understanding of what the specific drivers are within each of these categories.

Barriers

The three most common barriers were *Unclear Implementation*, *Lack of Awareness*, and *Faculty Divisions*. Each of these codes is described in Table 3.

Table 3. Common barriers

Unclear Implementation	Don't know how to assess if doing ELITE PD practices, their appropriateness, or how to implement them effectively
Lack of Awareness	Participant indicates they are unaware of policies, structures, happenings/efforts in the department/institution related to or aligned with ELITE PD practices
Department Support	Disagreement and/or unwillingness among faculty/lecturer groups with regard to implementing ELITE PD practices. (e.g., tenured vs. un-tenured faculty; lecturers vs. faculty; etc.)

An interesting difference between the most common barriers and drivers was that the barriers varied across the institutions. For Beta University, the top three common barriers were Unclear Implementation, Lack of Awareness, and Faculty Divisions, which is consistent with the overall list described above. However, for Epsilon University, the top three common barriers were Unclear Implementation, Faculty Divisions, and Not-My-Job, and for Gamma University, the top three common barriers were Lack of Awareness, Focused on Metrics, and Misinformed/Theorizing, which includes codes not on the overall common barriers list above. It was important to delineate by institution, as the number of interviews were not the same for each institution. Further, examining barriers by institution allows us to better understand the role that local contexts can play when engaging in PD work focused on active learning, equity, and inclusive teaching strategies.

In addition, we found that the Not-My-Job code was used to note when the interviewee stated that something focused on ELITE PD practices was not part of their job. We found that this was not necessarily a strict barrier as we had originally thought it would be. Rather, it tended to mark instances the interviewee recognized that there were other people more qualified to address specific aspects or tasks in the department. In contrast, Focused on Metrics was a code used to note times the interviewee was more focused on the metrics of the department over the implementation of ELITE PD practices and Misinformed/Theorizing was used to note times the interviewee made a statement about ELITE PD practices that was not correct (e.g., active learning is not possible in large classes).

Conclusion

Understanding the barriers and drivers that can support or impede the implementation of an MGTA PD program focused on active learning, equity, and inclusion is important because they can be used to encourage the adoption of such a program. While drivers did not vary much across the three institutions, barriers did. As barriers can play an important role in hindering implementation of a PD program, understanding what those barriers are can help in knowing how to best leverage drivers in order to implement change. For example, the focus on metrics at Epsilon University could be leveraged in such a way that data collected for assessing impact of a PD program could include metrics that 'speak' to administrators and leaders. Lack of awareness and/or unclear implementation, on the other hand, may require a focus in communication and enhanced training to support PD efforts. Such a focus could also address the barrier of misinformed/theorizing. Moving forward, we aim to understand how institutional-specific barriers can be addressed through existing drivers.

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