Graduate Student Peer Mentoring Experiences as a Component of a Multi-Faceted Graduate Teacher Training Program

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Peer mentoring programs are one approach to improving the pedagogical development of mathematical sciences graduate students. This paper describes the peer mentoring experiences at three institutions that have implemented a multi-faceted GTA professional development program. Data was collected from surveys and focus groups conducted with graduate teaching assistants at each institution regarding mentees' ratings of their mentors, mentors' ratings of their impact on mentees, mentors' impressions of the benefits and challenges of peer mentoring, and mentees and mentors' ratings of program components related to support from mentors, their TA coach, program staff, and other graduate students. Most GTAs found value in participating in the peer mentoring program. While the mentees found their mentors to be significant to their own success and effectiveness, the mentors did not rate themselves as high as the mentees rated them with respect to their own significance in impacting the effectiveness of their mentee.

Keywords: graduate teaching assistants, peer mentoring, GTA training

Graduate Teaching Assistants (GTAs) in the mathematical sciences are often responsible for a significant portion of the entry-level undergraduate instruction at doctoral-granting universities in the United States (Eller, 2017). Consequently, departments in the mathematical sciences across the country have been implementing instructional and professional training programs to enhance GTAs teaching abilities; the goal is to improve existing and future undergraduate mathematics pedagogy (Gutmann et al., 2005; Ellis, 2014). In an assessment of a GTA professional development program at a large doctoral-granting institution, Ho and Pilgrim (2020) found that most of the participants envision teaching as a significant, if not, the main role in their future careers; furthermore, all participants pointed out that along with the positive outcomes already happening in their classes because of the pedagogical training, their communication skills and teaching confidence were meliorating as well.

Peer mentoring is one of the formal components that institutions have introduced in order to help develop GTAs teaching and research abilities (Flores-Scott & Nerad, 2012). Based on the classical mentor-apprentice model, Treston (1999) describes mentorship as a "relationship in which the mentor provides support, advice, feedback and guidance" to the mentee. Moreover, mentor-mentee conversations, especially after a class observation, are highly valued by GTA peer-mentors as a gateway to constructive criticism (Yee & Rogers, 2017). Additionally, Browne-Ferrigno and Muth (2012) explain that peer relationships in higher education consist of mutual support and sharing of resources. Fittingly, it has been found that peer-mentoring relationships among graduate students help them acquire knowledge and grow professionally (Lorenzetti et al., 2019). Considering the impact of peer-mentoring in GTAs' pedagogical training, it is imperative for universities to pursue its betterment and research its foundation.

Belnap and Allred (2009) reported the need for research that explores the reasons why graduate assistant development programs impact their participants and how it happens, and not just the outcomes of this impact. Hence, this paper explores mentees' and mentors' perceptions of the peer mentoring program during the first year of the program implementation and during the March 2020 transition to emergency remote instruction due to the COVID-19 pandemic. semester.

This study aims to address this need by examining the experiences of mathematics and statistics GTAs at the three institutions where PSUM-GTT operates, leading to the three research questions that guided this study.

1. How did mentees and mentors perceive the mentor's impact on the mentee's success as an educator and on their transition to remote instruction and/or tutoring?
2. What reasons did the mentees and mentors provide for their ratings?
3. What benefits and challenges did mentors identify in terms of their own development as an educator?

Theoretical Framework

The PSUM-GTT program was based on a social theory of learning by Wenger and Lave (1991). We claim that mentors and mentees learn and grow through their membership in intersecting communities of practice, namely the communities of mentors and of mentees, both of which are nested within the departmental teaching and learning community. Professional learning communities in educational settings have been shown to have a positive impact on both pedagogy and on student outcomes (Vescio, Ross, & Adams, 2008). As GTAs meaningfully engage with peers and faculty mentors in these communities, they develop their pedagogical expertise and refine their practices (Lave & Wenger, 1991; Chi, 2006). Consequently, GTAs become more active in the social-professional communities of educators within their departments, and they shape their identities in relation to those communities (Wenger, 1998). We also posit that the impact of participating in these communities of practice is magnified for those GTAs who serve as both mentees and as mentors, as the viewpoints obtained through their roles provides varied insights into the practice of teaching. Relevant here, we also believe that serving as a mentor contributes to the development of the GTAs as future professional educators.

The Context: The PSUM-GTT Program

The Promoting Success in Undergraduate Mathematics Through Graduate Teaching Assistant Training (PSUM-GTT) program is a comprehensive graduate teaching assistant (GTA) training program in mathematical sciences that was designed and refined at one institution and is being replicated at two peer institutions. The program components include a first-year teaching seminar, peer mentoring and support from a peer TA coach, a Critical Issues in STEM Education seminar, and K-12 outreach to inform the GTA's understanding of the paths that students take before entering the university. The program goal is to strengthen the teaching capabilities of mathematical sciences GTAs in order to improve the academic outcomes of the undergraduates that they teach. Intended outcomes include GTAs' increased preference for student-focused instruction, satisfaction with their teaching training and mentoring, increased attention to equity and inclusive pedagogy in the classroom, and decreased rates of their undergraduate students earning grades of D or F or withdrawing.

Peer Mentor Training

The peer mentor training offered in the PSUM-GTT program is conducted every fall semester and requires approximately 8-10 hours of time spread over two asynchronous training modules and up to 3 synchronous meetings. The mentor training goals are to (a) clarify the role and purpose of the mentor, (b) provide training that will support mentors in fostering a good working relationship with mentees, (c) provide tools that promote conversations and reflection about teaching and learning, (d) provide training in effective coaching tools and techniques, (e) train mentors to conduct teaching observations and provide effective feedback, and (f) provide support and mentoring to the mentors.

The coaching tools that are demonstrated in the training include: (a) supporting GTAs in considering and being open to new perspectives about teaching and learning, (b) bringing awareness to how people listen and to introduce the concept of listening like our lives depend on it, (c) teaching mentors how to seek permission before giving coaching, (d) training mentors in giving specific and concrete praise to their mentees, (e) teaching mentors how to hold space without giving coaching so that mentees can process their struggles, burdens, or frustrations, and (f) training mentors in effective goal setting.

Method

Data Collection

At the end of the spring 2020 semester, all 46 graduate students participating in the program completed an online survey in Qualtrics that addressed mentoring relationships, spring 2020 teaching experiences (including a focus on active learning and equity in the classroom), and overall impression of the program components. This paper focused only on the following survey items relating to mentoring: a pair of Likert survey items that asked mentees and mentors to rate the mentors influence on success as an educator and transition to remote instruction using a 5-point scale, the open-ended questions that immediately followed these Likert items that prompted the respondents' rationale for ratings, one open-ended item each about positive and negative impacts of being a mentor, an open-ended and a single Likert item about overall perception of the mentoring component of the larger PSUM-GTT program.

Participants

There were 11 graduate student mentors, 12 mentees, and 1 TA coach at Institution A; 8 graduate student mentors, 3 faculty mentors, 12 mentees, and 1 TA coach at Institution B; 10 graduate student mentors and 12 mentees at Institution C, all of whom chose to participate in the comprehensive training program. At Institution A, 56.5% of participants identified as male and 43.5% identified as female. Approximately 65.2% of participants were international students. At Institution B, 46.5% of participants identified as male and 43.5% identified as female. Approximately 13.0% of participants were international students. At Institution C, 45.5% of participants identified as male and 54.5% identified as female. Approximately 40.9% of participants were international students. All three universities are considered to be research-intensive.

Analysis

Descriptive statistics (e.g., means and percentages) were used to summarize Likert survey items. Thematic analysis (Braun & Clarke, 2006) was used to analyze the open-ended survey responses.

Results

Mentees' Ratings of Mentor's Influence

Approximately 67% of mentees at Institutions A and C and 83.4% at Institution B rated their mentor as being at least somewhat significant in their effectiveness as a GTA (i.e., instructor of record, recitation section leader, tutor) during the 2019-2020 academic year (see Table 1). At Institutions B and C, mentees' ratings with regards to their mentors' influence on their transition to remote instruction were lower. Approximately 50% of mentees at Institution B and 33% at Institution C rated their mentor as being at least somewhat significant in their transition to remote instruction during the Spring 2020 semester due to the Covid-19 pandemic.

Table 1. Mentees' Rating of Mentor's Significance on Mentees' Effectiveness

Response Category	**Overall, how significant do you believe your mentor was to your success ... as a GTA this school year?**			**in your transition to remote instruction?**		
	Inst. A	Inst. B	Inst. C	Inst. A	Inst. B	Inst. C
Not at all significant	1 (8.3%)	1 (8.3%)	0	1 (8.3%)	4 (33.3%)	1 (8.3%)
Not very significant	3 (25.0%)	1 (8.3%)	0	2 (16.7%)	2 (16.7%)	3 (25.0%)
Somewhat Significant	3 (25.0%)	3 (25.0%)	1 (8.3%)	4 (33.3%)	2 (16.7%)	1 (8.3%)
Significant	3 (25.0%)	2 (16.7%)	6 (50.0%)	2 (16.7%)	3 (25.0%)	2 (16.7%)
Very significant	2 (16.7%)	5 (41.7%)	1 (8.3%)	2 (16.7%)	1 (8.3%)	1 (8.3%)

When reporting reasons for their ratings of their mentor's influence on their success as GTA during the 2019-2020 school year, positive impacts were attributed to the mentor giving advice/help (n = 9), providing encouragement (n = 5), and providing feedback on teaching (n = 3). While some mentees reported that there wasn't much communication with their mentor after the switch to remote instruction (n = 6) and/or that they relied on or were supported more by a course coordinator than their mentor during the transition (n = 2), others still found their mentor to be a source of advice (n = 4) or support and encouragement (n = 4). The three representative quotes below illustrate why mentees believed their mentors had a positive impact on their success as GTAs and in their transition to remote instruction. A mentee from Institution A stated, "I got help from my mentor at any time and also she always encouraged me." One mentee from Institution B reported, "My mentor was fantastic. [...] He also gave great feedback on how I can improve in the classroom." Another mentee from Institution C stated, "My mentor was a constant source of encouragement and reassurance, especially in the shift to remote instruction."

Mentors' Ratings of Their Own Influence on Mentees

While 83.3% of mentors at Institution C rated themselves as being at least somewhat significant in their mentee's effectiveness as a GTA during the 2019-2020 academic year, far fewer mentors rated themselves in a similar manner (58.4% and 33.4% at Institution A and B, respectively) (see Table 2). When discussing their reasons for how they rated their own influence, some mentors were more confident in their impact, such as one mentor at Institution B who replied, "I felt like I saw my mentee improve in concrete ways throughout the year." Some mentors reported that they specifically helped their mentees via answering questions and addressing concerns (n = 4), sharing ideas (n = 1), providing guidance about social or cultural aspects related to teaching (n = 1), and building the mentee's confidence (n =1). However, some (n = 4) believed that their mentees would have succeeded either way. For example, one mentor at Institution B stated, "My mentee is a good teacher, and I think she would still be a good teacher without me" and one mentor at Institution C reported, "My mentee was already a good teacher, but through our conversations, I believe we were both able to improve."

Table 2. Mentors' Rating of Their Own Significance on Mentees' Effectiveness

Response Category	**Overall, how significant do you believe your mentoring was to your mentee's success ...**					
	as a GTA this school year?			**in the transition to remote instruction?**		
	Inst. A	Inst. B	Inst. C	Inst. A	Inst. B	Inst. C
Not at all significant	1 (8.3%)	1 (8.3%)	0	5 (41.7%)	4 (33.3%)	0
Not very significant	2 (16.7%)	3 (25.0%)	0	1 (8.3%)	2 (16.7%)	7 (58.3%)
Somewhat Significant	4 (33.3%)	2 (16.7%)	8 (66.7%)	2 (16.7%)	2 (16.7%)	1 (8.3%)
Significant	3 (25.0%)	2 (16.7%)	1 (8.3%)	4 (33.3%)	0	1 (8.3%)
Very significant	0	0	1 (8.3%)	0	0	1 (8.3%)

Mentors' ratings of their own impact on their mentee's transition to remote instruction during the pandemic were lower, with approximately 50% at Institution A, 16.7% at Institution B, and 24.9% at Institution C rating themselves as being at least somewhat significant. Some mentors (n = 4) were able to see that they helped their mentees during this time, although the amount of credit they gave themselves varied. For instance, one mentor at Institution B said, "I was able to provide [mentee] with a little help and resources, but I don't feel I made a big impact." Another mentor at Institution A shared, "[The impact during the transition] is significant in terms of learning from each other by sharing experience, ideas, and some problems."

Some mentors felt they had less of an impact on their mentees during the transition to remote instruction. There were several reasons for this, including either the mentee or mentor not teaching during the spring semester (n = 4) or already teaching fully online (n = 1), the department faculty and staff providing the bulk of the support during the transition (n = 4), and diminished frequency of interaction (n = 6). For example, one mentor at Institution C reported, "[...] she did not have many issues, and she had a course coordinator who took over a lot of her duties, so she was able to make the transition smoothly without much help from me." Another mentor at Institution B said, "We didn't really meet very much once remote instruction started."

Mentors' Perceptions of Benefits and Challenges of Mentoring

Mentors shared that they believed that being a mentor in the program had a positive impact on them as instructors as they learned from their mentees (n = 10), reflected on their own teaching and/or growth (n = 13), grew their network (n = 2), and improved their leadership and/or listening skills (n = 3). A mentor at Institution A said, "I grew as a teacher. [...] this made me reflect on my teaching and make changes on it." One mentor at Institution B stated, "I always think there is a positive impact on my teaching by being a mentor. The act of mentoring and the process of thinking about teaching and how it could be better can always help." One mentor at Institution C reported, "It was fantastic. I was able to learn from someone by teaching."

Most mentors reported no negative impacts of the mentoring program. While two mentors mentioned the time commitment as a cost, neither indicated that the negatives outweighed the benefit. While one mentor said that having to assess why they taught the way that they did shook their confidence some, the other saw that same personal reflection as a positive. For example, one mentor at Institution C reported, "I was forced to question everything I did as a teacher, [...] In doing so I found habits that needed pruning, and also became more willing to attempt diverse strategies in the classroom."

Ratings of How Beneficial the Peer Mentoring Was to Mentors and Mentees

Mentees and mentors were asked to rate how beneficial the mentoring component of the training program was to them. Of those that answered the question, approximately 83.3% of the mentors at Institution A, 75.0% at Institution B, and 100% at Institution C rated the mentoring component as at least somewhat beneficial to them. Similarly, approximately 83.3% of the mentees at Institution A, 100% at Institution B, and 100% at Institution C rated the mentoring component as at least somewhat beneficial to them.

Discussion and Implications

Overall, the majority of mentors and mentees rated the peer mentoring component of the training program to be at least somewhat beneficial to them, which is consistent with previous literature about peer mentoring programs. The process of actively reflecting on their teaching in these intersecting learning communities, both independently and with their mentor/mentee counterpart, supported the refinement of the pedagogical practice of both the mentee and the mentor. Based on feedback from the mentees and mentors, the program had positive impacts on the mentees' success as GTAs and their transition to remote instruction when the COVID-19 pandemic started. The mentors additionally reported positive effects on their own growth as an instructor, as well as on their leadership and listening skills. While a practical concern related to GTA training and mentoring is the time commitment, few students mentioned this in their responses. Consequently, mentors and mentees alike belong to a departmental community where their teaching practices improve, and their growth occurs throughout their time as mentees and

later as mentors, even during unexpected circumstances such as the sudden transition to remote instruction due to the COVID-19 pandemic.

While mentees felt that their mentors made significant contributions to their teaching effectiveness, many mentors, in particular at Institution B, didn't feel that their contribution was as significant as their mentees gave them credit for. All of the mentors from Institution B had been a mentee prior to serving as a mentor and all but two had served as mentors in prior years. It is possible that these prior experiences of being mentored and/or being a peer mentor over multiple years, which are different communities of practice, may be adding another filter through which some of the mentors view their contribution to the development of their mentees progress as an educator and their own identities as effective mentors. The issue of self-efficacy as a mentor is interesting and warrants additional research. How is prior experience in the program either serving as a mentor or participating as a mentee impacting mentor self-efficacy? In what ways are mentors with low self-efficacy as a mentor, engaging differently with their mentees? What impact, if any, is that having on mentees? What can be done to improve the self-efficacy of mentors?

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