Graduate Student Instructors learning from peer observations

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Graduate Student Instructor (GSI) professional development addresses an urgent need to improve STEM retention. This paper focuses on a semester-long professional learning community in which six mathematics GSIs engaged in regular cycles of peer observation, feedback, and reflection. In contrast to most GSI development work, this approach emphasized that GSIs give, not just receive, peer feedback. Analyses of post-semester interviews indicated that all GSIs enhanced their noticing of students. Moreover, insight into peer feedback was developed along three dimensions: (1) the importance of being an objective observer, (2) the impact of working with equal-status peers, and (3) the value of critical feedback.

Keywords: Graduate Student Instructors (GSIs); Graduate Teaching Assistants (GTAs); Professional Development; Noticing; Reflection

Introduction

Introductory college calculus is a major barrier for students pursuing STEM careers (Bressoud, Carlson, Mesa, & Rasmussen, 2013); low student success rates in calculus contribute to a lack of persistence, which has become an issue of national concern in the US (PCAST, 2012). Fortunately, a growing body of evidence highlights the positive impact of student-centered teaching practices (Freeman et al., 2014), particularly in improving student persistence (Kogan & Laursen, 2014). Despite this evidence, college mathematics classrooms are still dominated by instructor-centered teaching (Lutzer, Rodi, Kirkman, & Maxwell, 2005). Thus, there is an urgent need to improve instruction in introductory undergraduate mathematics courses in the US.

Graduate Student Instructors (GSIs) play a crucial role in teaching these introductory mathematics courses. Yet, GSIs typically receive little professional development (Austin, 2002). To implement student-centered teaching practices, GSIs need to learn to attend to and respond to student thinking (Franke, Carpenter, Levi, & Fennema, 2001; Sherin, Jacobs, & Philipp, 2011). Accordingly, this paper explores how peer observations help GSIs enhance their noticing of student thinking. In contrast to observations by faculty or more experienced GSIs (Miller, Brickman, & Oliver, 2014), peer observation supports noticing through giving, not just receiving, feedback. It also helps alleviate the costs of scaling and sustaining traditional methods of observations, which may create an undue burden on faculty members and more experienced graduate students. In the present study, six mathematics GSIs met regularly in a professional learning community (PLC; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006) and engaged in cycles of peer observation, feedback, and reflection through the PLC.

This paper addresses two research questions: (1) how was GSI noticing impacted by peer observation? and (2) which features of peer observation supported or inhibited noticing? Analyses of post-semester interviews indicated that all six GSIs felt more reflective about their teaching. Moreover, they described: the importance of being an objective observer, the impact of working with equal-status peers, and the challenges of providing critical feedback. Based on these results, this paper argues that peer observations provide a number of additional learning benefits that extend beyond traditional observations of GSIs.

Theoretical Framing

Enacting student-centered pedagogies requires GSIs to build on the resources that students bring to the classroom. To build on these resources, GSIs need to engage in three related processes: attending to, making sense of, and responding to student thinking (Jacobs, Lamb, & Philipp, 2010). The study of such decision making comprises the field of *teacher noticing* (Sherin et al., 2011). The goal of the present work was to help GSIs enhance their noticing of students, rather than focusing primarily on themselves.

PLCs can enhance noticing, as instructors reflect on their practice with peer support (van Es & Sherin, 2008). PLCs are *communities of continuous inquiry and improvement,* with five key features: (A) shared values and vision, (B) collective responsibility, (C) reflective professional inquiry, (D) collaboration, and (E) group, as well as individual, learning (Stoll et al., 2006). In this study, the PLC gave GSIs opportunities to provide feedback, not just receive it. Given the benefits of peer assessment (Reinholz, 2015c), it was hypothesized that this would enhance noticing more than simply receiving feedback from others. Recognizing that not all feedback is equal (Hattie & Timperley, 2007), GSIs were helped to provide critical, supportive feedback to their peers. When feedback focuses on *processes*, it is more likely to draw attention to student thinking, in contrast to feedback focused on *people*, which will draw attention to the GSIs themselves (Reinholz, 2015b). Person-focused feedback, such as praise, actually inhibits learning (Hattie & Timperley, 2007; Mueller & Dweck, 1998).

Providing feedback position GSIs as competent (Engle & Conant, 2002), and there is evidence that individuals may learn as much from providing feedback as receiving feedback (Reinholz, 2015c). Thus, conducting observations rather than just being observed provided GSIs with opportunities for enhanced noticing. In particular, it allowed GSIs to enter the classroom as a third party without the cognitive load of teaching. This paper adds to the study of noticing and GSI professional development by elaborating these opportunities for improved noticing.

Method

Participants

Six GSIs teaching either calculus 1 or 2 at a large research-intensive university participated in the study. The calculus classes were comprised of (each week): (a) three 50-minute lectures, (b) one 50-minute recitation, and (c) one optional 100-minute workgroup. The GSIs each taught a combination of 3-4 recitations or workgroups. The recitations consisted of GSIs: answering homework questions, completing examples, providing short worksheets, and administering quizzes. The workgroup sessions were collaborative problem solving sessions, modeled on the Emerging Scholars Program (ESP; Treisman, 1992). A key insight from the ESP was that providing students with additional challenge, rather than remediation, was a more effective way to support their success in calculus. The collaborative groupwork sessions were also designed to promote community and collaboration amongst the students.

GSIs received no incentives for participation in the PLC; all four calculus 2 workgroup instructors participated as a part of the department's efforts to improve instruction, and two calculus 1 instructors were chosen by the department to participate. There were four female and two male GSIs, five domestic GSIs and one international GSI, and the GSIs had a variety of teaching backgrounds; the four female GSIs were in their first year of teaching in the department, and the male GSIs had been teaching for a number of years.

Design

The GSIs in the study met as a PLC and conducted regular peer observations during a single semester. The PLC was facilitated by a mathematics educator, who shared videos, articles, and feedback on teaching with the GSIs. The facilitator also assigned short "homework assignments," which required GSIs to implement active learning strategies in their recitations or workgroups. The PLC typically met every other week, for a total of seven one-hour sessions.

To help GSIs develop a shared vision (PLC principle A), GSIs reflected on and discussed their prior experiences as learners during the first PLC meeting. To support collective responsibility (principle B), reflective professional inquiry (principle C), and collaboration (principle D), the facilitator refrained from providing "answers" to the GSIs, instead creating opportunities for collective reflection and discussions of teaching. To support individual and group learning, GSIs had one-on-one conversations with their peers after observation, and the observations were later discussed collectively in the PLC (principle E). To create a safe space for these public conversations, the facilitator promoted a culture of sharing: each meeting began with a debrief on GSI experiences during the past two weeks. Moreover, the PLC discussed norms of giving feedback and normalized struggle as a part of learning.

The GSIs each completed 5-6 peer observations total, with three of their peers (two observations per peer). These observations were based on Peer-Assisted Reflection (Reinholz, 2015a). Each observation involved: (1) the GSI setting goals for the observation, (2) a peer observing and video recording the session, (3) a debrief conversation between the two GSIs after they both observed each other, and (4) a whole-group debrief during the next meeting.

To support feedback and reflection, the GSIs each completed peer feedback forms. The observed GSI began by listing their goals for what they wanted a peer to pay attention to. Then the peer provided specific examples to answer three questions: (1) What opportunities did students have to talk about mathematics?; (2) What opportunities did students have to work with other students?; and (3) What else did you notice, both related to the instructor's goals and otherwise?

Data Sources and Analysis

Pre and post interviews were conducted with the GSIs. In addition, all group meetings were audio recorded, and peer observation forms were copied. The pre-interviews provided context and background on the GSIs; the post-interviews were used as the basis for the analyses that follow. The post-interviews focused on the following areas: teaching philosophy, Peer-Assisted Reflection, experiences exchanging feedback, and beliefs about feedback. The goal of the interviews was to holistically understand how the GSIs experienced exchanging peer feedback, including: how they felt, what they learned, and what challenges they encountered.

All interviews were transcribed and coded by the researcher. The goal of coding was to understand how GSI noticing was impacted by peer observation. Drawing from techniques in grounded theory (Glaser & Strauss, 1967), a first pass of coding was conducted to identify emergent themes. These themes were: (1) objective observers, (2) equal-status peers, and (3) critical friends. Once these themes were identified, the researcher completed a second pass of coding to look for the prevalence of themes across the six post-interviews. The presentation of results that follows is illustrative, intended to highlight important areas for future research. All names below are pseudonyms.

Results

Objective Observers

All six GSIs discussed how they became more reflective about their teaching and improved their noticing of student thinking as a result of observing their peers. For example, Leo contrasted his years of prior experience with his engagement in the PLC,

> I didn't really think that much about teaching. I would sort of hope my students did well on the tests and give me good [ratings], but thinking about the process is something that I've really gotten out of this, and to really try to empathize a little and put yourself in the students' shoes and ask what is this teacher doing, or what should this teacher be doing.

Leo describes that teaching was something he did for many years, but "didn't really think that much about." In contrast, the PLC provided Leo with time and space to reflect on his teaching, learning to put himself in "students' shoes." Leo described the importance of observations, which allowed him to be in a classroom unburdened with the responsibilities of teaching,

> Well when you're not constantly running around helping people with math, it's really easy to tell when groups have sort of lost focus. You also get a better feeling for, I think, the dynamic between people, seeing how certain groups view their teacher…

In other words, peer observations supported Leo to improve his noticing of students, because they provided him with an opportunity to focus *only* on students, rather than all of the other responsibilities associated with teaching. Similarly, Tina described enhanced noticing resulting from being an observer,

> I was able to pay more attention to students' interactions in other workgroups. I guess I learned something about how the students interacted...I feel like there were the different groups. There was the group that had a ringleader that would get everyone going and would lead everything, and then there were some groups that would just not be working, and then there were groups that would be working pretty well together.

Broadening from the specifics of student-student interactions, peer observations allowed the GSIs to compare the different types of classroom environments that their peers created. For instance, Celeste reported on insights developed by comparing three different peer classrooms,

> I knew that I have some problems with my recitations, I knew that I'm not as good as I should be. And observing Tina and Tara and Elayne I saw, OK, this one's not working so probably I should not do it, and this one is working.

Celeste describes noticing what was "working" and "not working" in her peers' classrooms, which informed what she herself would do as a teacher. In this way, being present in a variety of peer classrooms allowed Celeste to see various gradations in teaching practices, which is a key aspect of identifying a high-quality performance (Sadler, 1989).

The observations also provided GSIs with concrete instances of student-centered teaching. For example, Elayne emphasized the value of watching Edgar teach, who focused on "guiding students" rather than just "giving them the answer,"

> Well I learned a lot about just the whole guiding students to the answer instead of giving them the answer, just watching other people- like I keep bringing up Edgar, because I think he was one of my favorite people to observe because he would literally just ask questions the whole time and not give any answers.

Elayne further described how such observations changed her views on teaching,

> A big role that I found this semester was just learning to ask the right questions and having patience… if the student is able to get to the answer on their own instead of you just giving them the answer, it builds their confidence and they retain it longer. Even though it might take three times as long for the student to get there instead of you just showing it to them, in the end they're going to do better in the class and be able to learn the math better if you allow them to get to it eventually.

As the above interview excerpts highlight, observing their peers provided opportunities for the GSIs to notice new things in the classroom. Although changes in GSI teaching practices were not analyzed, prior research showed that working with GSIs in the same department in a similar setting resulted in measurable changes in practices (Reinholz et al., 2015).

Equal-Status Peers

An important feature of the PLC was that the GSIs observed peers of relatively equal status. This contrasts approaches that focus on "experts" (experienced GSIs or faculty members) observing or being observed by "novices" (new GSIs). This allowed the GSIs to form community with their peers. As Leo noted, the PLC helped him shift from competition to collaboration,

> It was kind of a nice supportive environment. I really liked our group meetings where we sort of realized we're all in the same fight. Sometimes there's a little bit of competition, at least in my mind, between [GSIs], because you really want to have good [student ratings] and that's sort of only measured relative to a baseline. So you're like I want to be the best, I want my students to love me the most. But really more interesting are these questions of how do we prepare our students, all of our students, the best, and how do we teach the best. It was good to have actual regular meetings with other teachers in a way that... I don't know. It was a good emphasis on pedagogy, reminding myself why I'm actually there. It's not to get high scores, it's to teach kids math.

The GSIs also discussed the culture of mathematics and the pressure to understand all of the mathematics that they were teaching at a deep level. When the GSIs observed their peers and realized that their peers also found aspects of the mathematics challenging, it was reassuring for them. Even Edgar, who was a relatively experienced GSI, noted that the peer observations helped him overcome aspects of his imposter syndrome,

> [T]hey're also not crazy experts with the material. In learning that I felt more comfortable…There were instances where I was like I know how sequences and series work, and then I'd try and teach somebody how sequences and series work and I'd be like ah, fair enough, I don't know how sequences and series work…just seeing that [other

> GSIs] were also struggling with that is reassuring, that I shouldn't feel the imposter syndrome or anything like that.

Edgar's comments speak to broader cultural issues around mathematics, in which mathematics is often equated with intelligence (Nasir & Shah, 2011) and there is great pressure for the GSIs to act as authorities in the discipline. In observing Tina, Edgar noticed that she would often look at the solutions to problems during in the middle of workgroup sessions, and he realized that it was all right for him to do the same thing,

> So I was like, OK. I've always kept the solutions in my back pocket, so then it feels weird to, like, here are the solutions right in front of the group. Leaving and saying work on this and then refreshing privately, so to speak, so you maintain the aura of knowledge.

Here Edgar describes a concrete strategy, leaving and looking at answers away from the group, that allowed him to maintain what he perceived as his necessary authority as an instructor, while "refreshing" his understanding of the mathematics.

The idea of an "aura of knowledge" speaks strongly to narratives tying mathematics and intelligence (Nasir & Shah, 2011) and the perception of authority that GSIs felt that they had to maintain. Related to these narratives, Tara expressed anxiety in being observed,

> I mean sometimes the students would ask really hard questions and I wasn't completely sure of the answer, so I was worried that I'd be judged for being stupid by the other [GSI] basically.

As Tara expressed, the GSIs felt pressure to be experts. Addressing this "anxiety" has potential to support GSIs through peer observation and in GSI development more generally.

Critical Friends

All six GSIs stated that they found critical feedback to be more helpful than praise. For instance, Celeste discussed how overly positive feedback did not support her learning,

> Tina and Tara…they were always happy with the things that I wanted them to look at and I don't think that's very accurate…I think they wanted to be encouraging, like keep doing that, it's good. But I kind of liked Elayne's [feedback] the best because she actually provided actual things that I have to improve.

Upon receiving this not-so-helpful feedback, Celeste recognized that when she provided the same types of feedback to her peers it must also not be so helpful for them. As such, she altered the feedback she provided to peers to be more critical,

> I know that at the beginning I was like everything's great, nice, you're doing good. So I did that, and I know I did it. I didn't know them or what they would think, how they would react, would they get angry, so I wanted to be positive. But after Elayne I understood that's not the point. I knew when we talked that that's not the point, but it's different when you actually experience it. After that I tried to be more critical.

Celeste describes the initial barrier to providing critical feedback; she did not want to hurt the feelings of her peers or be judged by them. Yet, as she received critical feedback from Elayne, she realized that this was an important part of supporting her peers to grow, and changed her feedback accordingly. Edgar similarly described critical feedback as supportive,

> It's kind of like if I have to write a cover letter for my next job application and I hand it to my good friend Joe, and Joe says this is awesome, well done, I think you're going to get the job, you're a cool person, I would hire you. I'm like thanks Joe, you're nice. And then I give it to my good friend Stephanie – and I don't have any friends named Joe or Stephanie, these are made up names – and she says well, you know, it's passable. I've seen cover letters like this, I've written cover letters like this. It's good, but you could do better. There's this and this. I write like this, so when I read your handwriting doesn't make any sense to me. Take it or leave it, because when people read my handwriting they say the same thing to me. Tonal choices. This whole paragraph, what does it mean? It doesn't mean anything, I didn't get anything from it. What were you saying with that paragraph? It's like thanks Stephanie, I feel like I'm going to get the job now because I'm going to get rid of that paragraph and write something useful.

Here Edgar contrasts being "nice" with being "supportive." Edgar describes two imaginary friends, Joe and Stephanie giving him feedback on a cover letter. Joe is *nice* because he provides encouragement, but Stephanie is *supportive* because she provides critical feedback that can be used as fodder for improvement. In this professional context, Edgar emphasizes that support is more useful than niceness, and will actually help him get a job.

Discussion

The present paper provides evidence that peer observation can enhance noticing. In particular, when GSIs are positioned as competent to provide meaningful feedback to their peers, they can learn through observing others and form meaningful community with equal status peers. As such, equal-status peer observation can improve GSI professional development. For instance, it offers a low-cost alternative to observations conducted by faculty or experienced peers, because the very process of observing GSIs becomes a learning experience for the observer rather than a "cost" for the observer in service of another GSI's learning. Moreover, it gives GSIs an opportunity to interact with students in a different capacity, increasing their understanding of their students. Despite the benefits, peer observations can be inhibited by the inter-personal challenges of GSIs criticizing other GSIs who they view as friends or colleagues. Addressing this issue requires building an environment that supports supportive, critical exchange.

This paper also suggests new directions for research in teacher noticing. While peer observation as a tool for noticing appears promising, further research is required. In particular, the mechanisms through which peer observation can support individual reflection need to be further elaborated. Moreover, further research is required to understand how this type of reflective community practice impacts the actual teaching of GSIs in the classroom. These are promising avenues to continue this work.

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References

Austin, A. E. (2002). Preparing the next generation of faculty: Graduate school as socialization to the academic career. *The Journal of Higher Education*, *73*(1), 94–122.

Bressoud, D. M., Carlson, M. P., Mesa, V., & Rasmussen, C. (2013). The calculus student: Insights from the Mathematical Association of America national study. *International Journal of Mathematical Education in Science and Technology*, *44*(4), 685–698. http://doi.org/10.1080/0020739X.2013.798874

Deshler, J. M., Hauk, S., & Speer, N. (2015). Professional Development in Teaching for Mathematics Graduate Students. *Notices of the AMS*, *62*(6), 638–643.

Engle, R. A., & Conant, F. R. (2002). Guiding principles for fostering productive disciplinary engagement: Explaining an emergent argument in a community of learners classroom. *Cognition and Instruction*, *20*(4), 399–483.

Franke, M. L., Carpenter, T. P., Levi, L., & Fennema, E. (2001). Capturing teachers' generative change: A follow-up study of professional development in mathematics. *American Educational Research Journal*, *38*(3), 653–689.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, 201319030. http://doi.org/10.1073/pnas.1319030111

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine Publishing Company.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*(1), 81–112. http://doi.org/10.3102/003465430298487

Jacobs, V. R., Lamb, L. L. C., & Philipp, R. A. (2010). Professional Noticing of Children's Mathematical Thinking. *Journal for Research in Mathematics Education*, *41*(2), 169–202.

Kogan, M., & Laursen, S. L. (2014). Assessing Long-Term Effects of Inquiry-Based Learning: A Case Study from College Mathematics. *Innovative Higher Education*, *39*(3), 183–199. http://doi.org/10.1007/s10755-013-9269-9

Lutzer, D., Rodi, S., Kirkman, E., & Maxwell, J. (2005). Statistical abstract of undergraduate programs in the mathematical sciences in the United States: Fall CBMS 2005 Survey. *Providence, RI: American Mathematical Society*.

Miller, K., Brickman, P., & Oliver, J. S. (2014). Enhancing Teaching Assistants' (TAs') Inquiry Teaching by Means of Teaching Observations and Reflective Discourse. *School Science and Mathematics*, *114*(4), 178–190. http://doi.org/10.1111/ssm.12065

Mueller, C. M., & Dweck, C. S. (1998). Praise for intelligence can undermine children's motivation and performance. *Journal of Personality and Social Psychology*, *75*(1), 33–52.

Nasir, N., & Shah, N. (2011). On Defense: African American Males Making Sense of Racialized Narratives in Mathematics Education. *Journal of African American Males in Education*, *2*(1).

President's Council of Advisors on Science and Technology. (2012). *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics.* Washington, D.C.: Executive Office of the President.

Reinholz, D. L. (2015a). Peer-Assisted Reflection: A design-based intervention for improving success in calculus. *International Journal of Research in Undergraduate Mathematics Education*, *1*(2), 234–267. http://doi.org/10.1007/s40753-015-0005-y

Reinholz, D. L. (2015b). Peer conferences in calculus: The impact of systematic training. *Assessment & Evaluation in Higher Education*, 1–17. http://doi.org/10.1080/02602938.2015.1077197

Reinholz, D. L. (2015c). The assessment cycle: A model for learning through peer assessment. *Assessment & Evaluation in Higher Education*, 1–15. http://doi.org/10.1080/02602938.2015.1008982

Reinholz, D. L., Cox, M., & Croke, R. (2015). Supporting graduate student instructors in calculus. *International Journal for the Scholarship of Teaching and Learning*, *9*(2), 1–8.

Sadler, D. R. (1989). Formative assessment and the design of instructional systems. *Instructional Science*, *18*(2), 119–144. http://doi.org/10.1007/BF00117714

Sherin, M., Jacobs, V., & Philipp, R. (2011). *Mathematics teacher noticing: Seeing through teachers' eyes*. Routledge.

Stoll, L., Bolam, R., McMahon, A., Wallace, M., & Thomas, S. (2006). Professional Learning Communities: A Review of the Literature. *Journal of Educational Change*, *7*(4), 221–258. http://doi.org/10.1007/s10833-006-0001-8

Treisman, U. (1992). Studying students studying calculus: A look at the lives of minority mathematics students in college. *The College Mathematics Journal*, *23*(5), 362–372.

van Es, E. A., & Sherin, M. G. (2008). Mathematics teachers' "learning to notice" in the context of a video club. *Teaching and Teacher Education*, *2005*(24), 244–276.