Journal of the California Mathematics Project
Volume **11**, 2022

Research to Practice Sampler

Sustained Support for Teaching Assistants

Sean P. Yee and Kimberly Cervello Rogers

Abstract. Research to practice samplers provide a short review of the research literature on a topic and then offer some examples of professional learning activities that leverage the research. In this case, the topic is the preparation of graduate students for teaching college mathematics.

Continued teaching support for graduate students is critical as they progress towards and throughout their future careers, yet challenging due to the variations and transitions they encounter. Graduate students engage in various means of teaching, including assignments as teaching assistants (TAs, including recitation leaders, graders, emporium instructors, or tutors) and often progress to graduate student instructors (GSIs, where graduate students are instructor of record). Supporting graduate students' learning to teach while they are also responsible for teaching undergraduate mathematics students requires sustained professional development (Yee & Rogers, 2017, Rogers & Yee, 2018).

Research in sustainable professional development (PD) has found that certain teaching practices, known as generative teaching practices (Franke, et al., 2001), endure and continue to grow with novice instructors as they develop their teaching. Franke et al. found that the most pervasive generative teaching practices focused on student-centered instruction, documented through the ability of teachers to explain how a student perceives, thinks, and solves mathematical problems as well as how to create and modify tasks to enhance student understanding. Student-centered instruction differs from traditional TA training programs because the focus is on how students perceive, think, and solve rather than TAs' ability to present material (Belnap & Allred, 2009). Thus, sustained support should incorporate a focus on student-centered instruction to help TAs and GSIs continue to grow as effective instructors.

Fostering student-centered instruction among TAs and GSIs requires both a specific training focus and also buy-in from the graduate student culture. Specifically, a community of practice (Wenger, 1998) around student-centered instruction is needed to nurture graduate student teaching. There is limited literature at the university level about the impact of ongoing PDs with novice instructors (Speer et al., 2010), but there are many ways in which PDs can grow a community of practice. We describe two research-supported methods that can encourage this type of graduate student teacher development.

First, at some institutions, graduate students begin as TAs and then become GSIs, and at others graduate students are assigned as GSIs in their first semester in graduate school. These transitions to GSI can be jolting for graduate students (Rogers & Yee, 2017). To help them

transition, iterative Japanese lesson study can provide an opportunity for graduate students to collaboratively work together to teach a lesson, ideally during a semester course or seminar prior to the first semester they are GSIs. Lesson study is where multiple teachers work together to design and teach a lesson with a new teaching method. They then use formative assessment to analyze student understanding, discuss revisions, and reteach the lesson with a different instructor to see how their modifications affected student learning. Lesson study has been shown to be useful with graduate students transitioning to GSIs because it provides them a safe and supportive environment to try teaching methods around student-centered instruction (Yee & Rogers, 2016). Moreover, discussion among graduate students about how to teach a course naturally opens a dialogue around teaching, a necessity for establishing and sustaining a community of practice. After participating in an iterative lesson study process, GSIs can reuse the lesson study model to continue to grow with other new teaching methods that focus on student learning throughout their career.

Second, after graduate students become GSIs, continued support through observation cycles has demonstrated positive development towards student-centered instruction. Observation cycles (observation followed by post-observation feedback repeated multiple times) are used in primary schools (e.g., part of a coaching cycle, Gibbons & Cobb, 2017) and secondary schools (e.g., part of mentoring and induction, Portner, 2005). The number of observation cycles members of a mathematics department can provide TAs or GSIs is often limited by resources, but it is important that any observations include post- observation formative feedback—feedback communicated to the instructor intended to modify their thinking or teaching practices (Shute, 2008, p. 154). Similar to the value of formative assessments of student learning, formative feedback is important because it provides formative assessment of teaching. We have found similar results through a peer-mentoring model where experienced GSIs mentor and observe novices (Rogers & Yee, 2018; Yee & Rogers, 2017; Yee et al., 2019). Results suggests observation cycles should include post-observation discussions focused on specific areas of improvement, not evaluations. Specifically, formative feedback for novices should focus on student-centered (generative) teaching practices as discussed in the Mathematical Association of America (MAA) *Instructional Practices Guide* (2018).

Activities for Professional Learning About Teaching

Note that these are activities for which *the learners are people who teach mathematics*. The tasks might be used in a workshop or seminar for novice college mathematics instructors (e.g., graduate students learning to teach undergraduate mathematics). Each activity is based on resources that are publicly available.

Activity 1: Lesson Study Project for Student-Centered Instruction. Materials available at `https://seanpyee.wixsite.com/professional/resources` (Yee & Rogers, 2016)

Activity 1 Goals: Participants will:

- Collaboratively design and teach, revise, and reteach a lesson.
- Engage in the lesson planning process with a focus on measurable goals, formative assessment, and student-centered instruction.
- Reflect upon early teaching experiences and have open communication about how to revise teaching a lesson.

The purpose of Activity 1 is to provide a safe, supportive, and collaborative environment to prepare and teach lessons using the pedagogical content knowledge. Graduate students working as TAs or instructors of record will work in groups (no bigger than three) to (1) design a lesson plan with measurable goals with a focus on collecting student feedback from mathematical tasks, (2) teach the lesson, (3) revise the lesson according to the student feedback, (4) teach the lesson to a different class, (4) write a reflection on how the project informed their understanding of teaching. Only one graduate student needs to teach each lesson, but all group members must attend the both lessons and help in all steps of the process. The same graduate student need not teach the second lesson.

In departments where large lecture courses are taught by instructors who coordinate with TAs as recitation leaders, the preferred method for the lesson study is to have the recitation TA ask their lecturer if they can teach their class for one class period. In departments without recitation sections, the professional development provider should contact faculty members to arrange the time and place for the lesson study group to teach a faculty member's class. In either scenario, lining up a second class time soon after the first is helpful for providing a way for the group to reteach their revised lesson and learn from the iterative process. This activity aligns with the ideas provided on the previous page because it can help graduate students transition to GSIs and build a community of practice around open discussion of lesson planning, teaching and collaboratively solving curriculum problems.

Activity 2: Observation and Post-Observation Feedback. Available in the MAA CoMInDS Resources collection, the Protocol and Feedback Form is an already formatted document. Note: To access it, sign up for a free MAA Connect account (membership in MAA is *not* required).

Activity 2 Goals: Participants will

- Use an observation protocol designed to focus on providing feedback with three sections, teacher, student, and lesson. All three revolve around student-centered instruction.
- Provide post-observation feedback formatively via Red-Yellow-Green comments that can be used for multiple observation cycles to showcase improvement.
- Describe specific active-learning techniques observed and prescribe active-learning techniques to improve student engagement.

The purpose of Activity 2 is to provide a graduate student instructor observation protocol (GSIOP) and a post-observation Red-Yellow-Green (RYG) feedback structure that promotes student-centered, actionable feedback. The GSIOP's cover page focuses on large and important ideas specific to GSIs. The student-, teacher-, and lesson-sections of the observation form have been developed to allow the observer to identify student engagement by attending to the nature of peer-to-peer, instructor, and course materials' interactions around mathematics content. The post-observation feedback is referred to as the Red-Yellow-Green (RYG) feedback and is designed to provide formative feedback for the GSI with manageable size units. The tool was designed to aid the observer in identifying what feedback is helpful for the GSI for continued growth in teaching. The RYG feedback has been designed to be formative and actionable so that the GSI can continue to develop teaching practices that can be referenced in future observations. Ideally, the GSIOP-RYG feedback observation cycle should be occur three or more times in a single semester to support ongoing teacher growth and development.

References

Belnap, J., & Allred, K. (2009). Mathematics teaching assistants: Their instructional involvement and preparation opportunities. In L. Border (Ed.), *Studies in graduate and professional student development* (pp. 11–38). New Forums Press.

Franke, M., Carpenter, T., 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.

Gibbons, L., & Cobb, P. (2017). Focusing on teacher learning opportunities to identify potentially productive coaching activities. *Journal of Teacher Education*, *68*(4), 411–425.

of America, M. A. (2018). *MAA Instructional practices guide.* Mathematical Association of America Press.

Portner, H. (2005). *Teacher mentoring and induction: The state of the art and beyond.* Corwin Press.

Rogers, K., & Yee, S. (2018). Peer mentoring mathematics graduate student instructors: discussion topics and concerns. In *Proceedings from 21st conference of the Research in Undergraduate Mathematics Education.* San Diego, CA.

Shute, V. (2008). Focus on formative feedback. *Review of Educational Research*, *78*(1), 153–189.

Speer, N. M., Gutmann, T., & Murphy, T. (2005). Mathematics teaching assistant preparation and development. *College Teaching*, *53*(2), 75–80.

Speer, N. M., Smith III, J. P., & Horvath, A. (2010). Collegiate mathematics teaching: An unexamined practice. *The Journal of Mathematical Behavior*, *29*(2), 99–114.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* Cambridge University Press.

Yee, S., Deshler, J., Rogers, K., Petrulis, R., Potvin, C., & Sweeney, J. (2019). Bridging the gap: From graduate student instructor observation protocol to actionable post-observation feedback. In *Proceedings of the 22nd conference on Research in Undergraduate Mathematics Education.* Oklahoma City, OK.

Yee, S., & Rogers, K. (2016a). Graduate students' pedagogical changes using iterative lesson study. In *Proceedings from 19th conference of the Research in Undergraduate Mathematics Education* (pp. 1458–1466). Pittsburgh, PA.

Yee, S., & Rogers, K. (2016b). Lesson study project for student-centered instruction. *Lesson Plan*. Retrieved from `http://seanpyee.wixsite.com/professional/resources`

Yee, S., & Rogers, K. (2017). Mentor professional development for mathematics graduate student instructors. In *Proceedings from 20th conference on Research in Undergraduate Mathematics Education* (pp. 1026–1034). San Diego, CA.