A THREE-TIERED TRAINING PROGRAM FOR GRADUATE TEACHING ASSISTANTS

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Contemporary buzzwords such as analytics, big data, and data science, plus the growing demand for individuals who can work with data, have led to record numbers of students being interested in taking statistics courses. Due to an increased demand for upper-level statistics courses, many universities rely on graduate teaching assistants to facilitate the introductory level courses. Unfortunately, not all graduate teaching assistants (GTAs) have the preparation necessary to be immediately successful in the classroom for a variety of reasons such as a lack of content preparation, a lack of teaching experience, and/or a lack of support. I will describe the evolution of our three-tiered GTA training program which we believe provides the required statistical content knowledge, the necessary pedagogical strategies, and a supportive learning community.

Student demand for statistics courses is growing, yet with their limited resources, many universities are finding it difficult to staff all their introductory courses with continuing faculty. One solution used to free up tenure-track faculty to teach upper-level statistics courses is to rely on graduate assistants to teach the introductory service courses. As the course coordinator for our algebra-based introductory statistics course, I recognized the need for a more consistent, formal Graduate Teaching Assistant (GTA) training program. Few GTAs have ever taken an introductory statistics course for non-majors, and while they have a strong theoretical understanding of statistics, their conceptual knowledge was often very weak (Kaplan & Roland, 2017), and even fewer have a rudimentary understanding of best practices pedagogy.

The duration, content, scope, delivery method, and format of GTA training programs are quite varied (Justice, Zieffler, & Garfield, 2017). Some are generic, university-wide, training programs. Others are department specific. Some training programs are intensive one-day sessions, some require a week-long commitment, and others span several weeks, or even a semester. Some concentrate only on pedagogy and/or development of a teaching philosophy, whereas others are content specific.

No matter which format your GTA training program follows, there are common problems or issues involved. In an USCOTS'17 Workshop facilitated by Jennifer Kaplan et al., several key issues in training GTAs were discussed which can be arranged into four main categories: motivation, acquisition of content, development of pedagogical skills, and enculturation. One's motivation, or lack thereof, is based on intrinsic factors unique to each individual. However, departments can effectively address the content knowledge, pedagogical skills, and enculturation of GTAs. These three issues are the three tiers on which our GTA training program is built. While there is no "one-size-fits all" approach, I will discuss what has worked well for our department as our GTA training program has evolved over the last four years.

During the first year of implementation, my primary focus was on developing the GTAs' statistical content knowledge. I instituted weekly meetings during which the GTAs had the opportunity to ask questions about the content that would be taught in their classes during the upcoming week. They worked through problems together, discussed common student misconceptions, developed examples to assist them in explaining the content, and worked through the activities they would facilitate with their classes. However, while observing the GTAs teaching their lab sessions, I noticed that they struggled with timing the lesson properly, knowing what points to emphasize, allowing students to struggle with the content, developing natural closure, and helping students to draw connections between the lab activity and previous class content. In response to the pedagogical issues I observed, I created a lab activity script with suggested timings that indicated how to introduce the objectives and the activity along with any necessary demonstrations, the tasks to be completed by the students, points to emphasize, and techniques to wrap up the lesson.

During the second year, I concentrated on creating a supportive learning community of all

who taught introductory statistics by inviting the other introductory statistics instructors to join in the GTA training sessions. I felt that all involved would benefit from hearing other approaches to teaching the content. Including the other instructors led to a more consistent introductory statistics course as the students in the different sections completed the same activities, projects, and assessments. The evolution of a cohesive team was an added benefit of including all introductory statistics instructors in the GTA training meetings.

GTAs are assigned to teams of 2-3, working with the same supervising faculty member and sharing an office. Having the same schedule, they spend quite a bit of time socializing, sharing challenges, frustrations, and successes, and covering for each other when needed. Both formal and informal socialization with their team members helps them to continue to develop professionally (Wulff et al., 2004).

We also administer common exams in the evenings. All GTAs and instructors actively proctor the exams in large lecture halls in their small teams. After the exam, all GTAs and instructors grade the exams together, using an approach very similar to the Advanced Placement Statistics reading. Small teams of 2-4 individuals work together to grade an assigned question according to the rubric. If there is a question about how to score an exam, the teams develop consensus. Working together in this fashion provides support and builds camaraderie. Grading exams takes 1-2 days and meals are provided by the department. Sharing meals, of course, allows for even more time to develop community.

During the third year, my emphasis returned to developing the pedagogical skills of the GTAs. I asked the other instructors to take turns leading the weekly group meeting, sharing approaches to teaching content, demonstrating lab activities, and answering GTA questions. Additionally, since the department instituted a hybrid model (the flipped classroom approach), I began training both GTAs and instructors in implementation of the hybrid model.

As many of the GTAs were first year graduate students, they felt very pressured by having to prepare to teach as well as to complete their own coursework. If the GTAs could learn the statistical content prior to beginning their teaching roles, most of our weekly meeting time could be spent working on the best ways to deliver the content and facilitate the student-centered hybrid model. Thereby, an online GTA Training model needed to be created.

Ensuring that GTAs know the content from a theoretical and conceptual standpoint is paramount (Justice, Zieffler, & Garfield, 2017). GTAs will not be able to adequately explain concepts to their students or provide alternative methods to solve problems without a strong statistical foundation, and without conceptual understanding, GTAs will struggle in facilitating the lab activities and in allowing students to grapple with the material to create their own meaning (Kung, Speer, & Gueler, 2006). Additionally, a lack of statistical maturity makes it difficult for GTAs to correctly and consistently grade open-ended student responses on lab activities and exams (Frank & Speer, 2013).

During the fourth year, we implemented an online training program to ensure that our GTAs have learned all statistical content they will need to know to be successful in performing their teaching duties. The online training is completed the semester before the GTAs are assigned to teach. They experience the expectations we have for our students by completing all the modules in both the introductory statistics and introduction to business statistics courses using the same assignments and assessments the students must complete. Moreover, after completing the homework and quizzes for each module, they reflect on areas in which they struggled with content, as well as where they believe students will struggle. They develop their conceptual understanding of the content as they think through alternate ways to explain the concepts; and they post their thoughts and ideas about how they will help students to understand the content on a discussion board. The online program gives the GTAs an opportunity to review statistical content at their own pace, learn new software, reflect upon areas of confusion for students, and begin to build a learning community and relationships with the other GTAs.

Enculturation, the development and acceptance of group norms, takes time. We start the process in the online component, as this is where GTAs are first exposed to the expectations of the department and where they begin to create a learning community by posting and responding to each other in the online discussion forums. Our first face-to-face GTA meeting is extremely important as it sets the tone for the semester. During this meeting we spend time discussing their

statistics and teaching backgrounds, what makes a great class, any concerns they have about teaching, the hybrid model, and classroom issues such as confidentiality, classroom management, academic dishonesty, and emergency situations.

The face-to-face component consists of all introductory statistics instructors and GTAs meeting on a weekly basis to discuss issues related to their respective courses. Time is spent teaching (and learning) the necessary content, discussing pedagogical approaches, anticipating areas where students may struggle, and creating a community. As implemented at the University of Georgia (Kaplan, et. al., 2017), we co-lead the meeting. One of the instructors will demonstrate how to lead the activity by facilitating it in our training session. As the course coordinator, I will interject comments about pedagogy, particularly why various aspects are considered key, how to ensure that students are actively involved, and which connections need to be stressed to assist the students in constructing their own meanings. GTAs apply what they learned in the training sessions as they lead two labs each week.

GTAs are incentivized to teach well through formative and summative evaluations, teamwork, and faculty mentorship. Department expectations and how GTAs will be evaluated are clearly communicated before the semester begins in both the online format and in the first face-to-face meeting. In our weekly meetings we discuss classroom issues and also take time to recognize GTAs who have gone above and beyond in their duties. GTAs also meet in small groups with their supervising instructor. During these and other individual meetings, GTAs hone their content delivery. If GTAs need assistance, there are many support people available. At the end of the year, the most outstanding GTA is recognized and awarded a cash prize.

Development of pedagogical skills also takes time. Justice, Zieffler, and Garfield (2017) mention that the two most promising development strategies are mentoring through regular meetings with faculty and teaching observations with feedback. Moreover, they state that "mentoring was the most influential of the factors for predicting student-centered teaching behaviors" (Justice, Zieffler, & Garfield, 2017, p. 298). Since many GTAs have not learned about reform-based teaching principles, they need to observe these methods in practice (Justice, Zieffler, & Garfield, 2017). Therefore, GTAs are required to attend the large class sessions taught by their supervising instructors.

All GTAs observe their supervising instructor and the course coordinator teach. In turn, each GTA's classroom performance is observed by their supervising instructor and the course coordinator. Post observation meetings are held in which the GTA and the observer discuss the lesson, specifically what worked, what didn't, what the GTA could do to improve it for next time, and any other insights. This provides the GTAs an opportunity to ask questions and to reflect on their instruction.

Even though many of our GTAs do not go on to teach, this opportunity is very valuable in their development as professionals in that it gives them the opportunity to communicate about statistics to a novice, non-technical audience, something that they will need to be able to do whether they work in industry or an academic setting. Knowing that they will be observed helps motivate the GTAs to prepare for their teaching duties. The post-observation conference also gives them the opportunity to reflect on their practice (Waldeck, 2017). During the second semester, after they feel more comfortable, each GTA is videotaped facilitating a lesson. Then, the GTA and observer watch the video. According to Pearl, et al. (2012), the use of video helps "instructors focus on particular pedagogical activities and students' thinking" instead of the individual actions of the teacher and students (p. 25).

While our GTA training model has evolved over time, it is the focus on the three tiers; developing content knowledge, developing pedagogical skills, and enculturation of the GTAs that has remained constant. While we have been able to address the key issues in working with GTAs, it hasn't been without its challenges and frustrations. We are still looking for ways to more efficiently train our GTAs. The amount of time and work required to coordinate all of the training and classroom observations is grueling. The enculturation process can be tricky, especially when working with international GTAs as different cultural expectations and ideas of professionalism can make communication difficult. Also, student evaluation of the instruction provided by GTAs is always a concern. However, we will continue the dialog with others who train GTAs and reflect on what we have done as we continue to grow and improve our training process.

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