

Exploring GTA Skills and Responsibilities to Inform a GTA Professional Development Program in Computer Science

Dr. Jill K. Nelson, George Mason University

Jill Nelson is an associate professor in the Department of Electrical and Computer Engineering at George Mason University. She earned a BS in Electrical Engineering and a BA in Economics from Rice University in 1998. She attended the University of Illinois at Urbana-Champaign for graduate study, earning an MS and PhD in Electrical Engineering in 2001 and 2005, respectively. Dr. Nelson's research focus is in statistical signal processing, specifically detection and estimation for applications in target tracking and physical layer communications. Her work on target detection and tracking is funded by the Office of Naval Research. Dr. Nelson is a 2010 recipient of the NSF CAREER Award. She is a member of Phi Beta Kappa, Tau Beta Pi, Eta Kappa Nu, and the IEEE Signal Processing, Communications, and Education Societies.

Dr. Yutao Zhong, George Mason University

Dr. Mark Huntington Snyder, George Mason University

Prof. Elizabeth L. White, George Mason University

Dr. Elizabeth White is an associate chair and associate professor of Computer Science and a member of the C4I center at George Mason University in Fairfax, VA. She has a Ph.D. in Computer Science from the University of Maryland, College Park and a B.S. in Computer Science from the College of William and Mary in Virginia. Her research and teaching interests include compilers, embedded systems, software architecture, middleware and programming languages. Dr. White serves as director of the BS Computer Science and BS Applied Computer Science programs at George Mason University.

Exploring GTA Skills and Responsibilities to Inform a GTA Professional Development Program in Computer Science

Introduction

This work-in-progress paper describes the process and initial outcomes of an effort to identify and prioritize content for a newly expanded graduate teaching assistant (GTA) training program in a computer science department. As part of an NSF-funded project that aims to transform teaching practices in highly enrolled gateway STEM courses, the computer science (CS) department at a research-focused state institution is working to integrate active learning practices in its CS 1 (freshman level) and CS 2 (sophomore level) courses. The combined courses have enrollments of nearly 1,000 students each semester, with lecture sections of 100-200 students and software lab sections of 25-30 students. Lab sections are led by GTAs, and hence GTA professional development plays a large role in transforming the teaching and learning approaches in these courses.

The CS department at the center of this study is growing rapidly, as the university in which it is housed is devoting significant resources to growing computing programs and emphasizing the importance of computing competencies across majors. As such, the number of GTAs needed to support courses in the CS department is also rapidly increasing and finding students to fill these roles is sometimes difficult. New GTAs are often new graduate students, many of whom are enrolled at a US institution for the first time. Recognizing that nearly all of the CS GTAs (over 75 in total) face similar challenges related to a lack of training and/or experience in college teaching, the department aims to create a department-wide GTA training program that expands upon their existing approach, which focuses on a start-of-semester half-day training.

Methods

To understand the main challenges faced by CS GTAs and to inform the development of a training program that makes the most effective use of limited resources (specifically funding, GTA time, and instructor time), the CS department surveyed GTAs, as well as instructors whose courses were supported by GTAs, at the end of the Fall 2020 semester. GTAs were asked what skills they view as most important to their success in fulfilling their responsibilities and their perceived level of preparation/skill for those responsibilities. GTAs' perceived level of preparation provides a window into their teaching self-efficacy, which can be measured over time to track teaching development [1]. GTAs were also asked what elements of their role were most challenging, and they were asked to rate the usefulness of both existing training elements and potential additions to GTA training in the department. Instructors whose courses were supported by GTAs were asked what competencies they viewed as most important and how skilled their GTAs were in those competencies. In both the GTA and instructor surveys, respondents were asked to rate importance and GTA preparation for items that were grouped into three sets: general preparation, pedagogical and communication skills, and software proficiency. The items included in the GTA and instructor surveys were adapted from those used in existing STEM GTA training research [2, 3] with additional items motivated by discussions within a departmental committee formed to oversee development of GTA training. Forty GTAs and 28 instructors completed the surveys. Aggregated survey results are described in the next section.

Results and Discussion

GTAs were first asked to rate how challenging they found various aspects of their role on scale of 1 to 5 with 5 representing the highest challenge. Five job aspects were provided, and respondents had the option to add other aspects not provided. The average ratings for the five aspects provided in the survey are shown in Table 1. Workload / time management was rated as the most challenging by a considerable margin, with interactions with students and knowledge of course material ranking second and third, respectively. Most respondents who added other challenges commented either on specific elements of workload (e.g., too much grading) or the difficulties of teaching online.

Aspect of GTA Role	Level of Challenge (1 to 5)
Course Material	2.13
Workload / Time Management	3.45
Interaction with Students	2.28
Interaction with Instructors	1.75
Technology	1.92

Table 1: Average challenge of five aspects of GTA role as reported by GTAs

Average responses to the importance and skill questions for both GTAs and instructors are shown in Figures 1 and 2. Results for general preparation and pedagogical and communication skills are shown in Figure 1; results for software skills are shown in Figure 2.

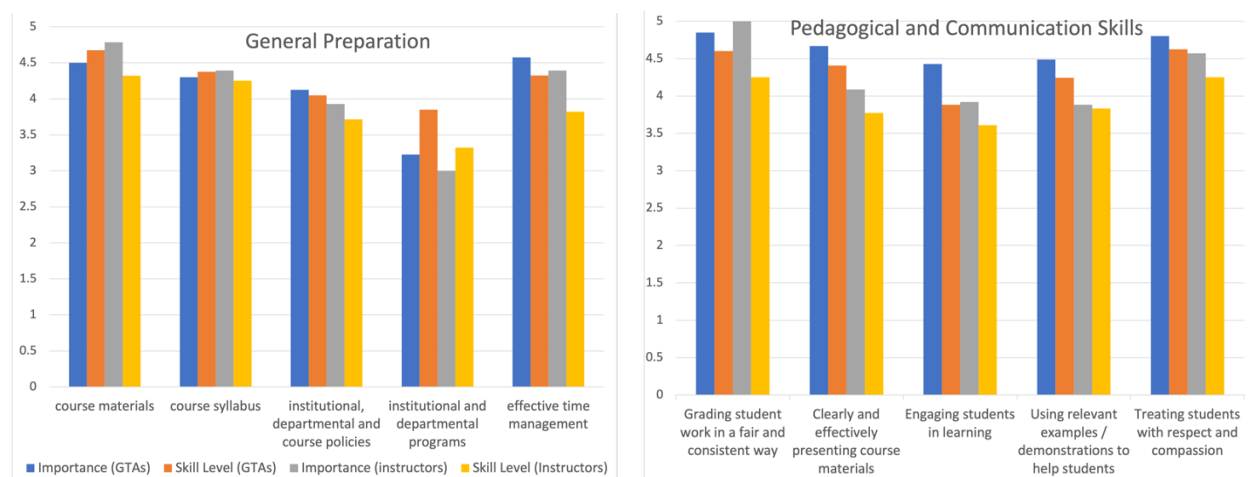


Figure 1: Average responses to survey questions focused on perceived importance and level of preparation for general course preparation and pedagogical and communication skills

With respect to general preparation, instructors and GTAs are in fairly close agreement about the relative importance and GTA skill level across the five items considered. Both groups view knowledge of the course materials and effective time management as the most important skills. Across all skills, GTAs rated their skill levels slightly higher than did instructors, though the average difference was small (less than 0.6). It is also worth noting that both instructors and GTAs viewed knowledge of institutional and departmental programs as relatively unimportant.

In pedagogical and communication skills, instructors and GTAs again identified the same two aspects, grading work fairly and treating students with respect, as most important. Again, GTAs' perception of their skill level was higher across all categories than was instructors' rating of GTAs' skill level. The largest difference (0.63) occurred for clearly and effectively presenting course material.

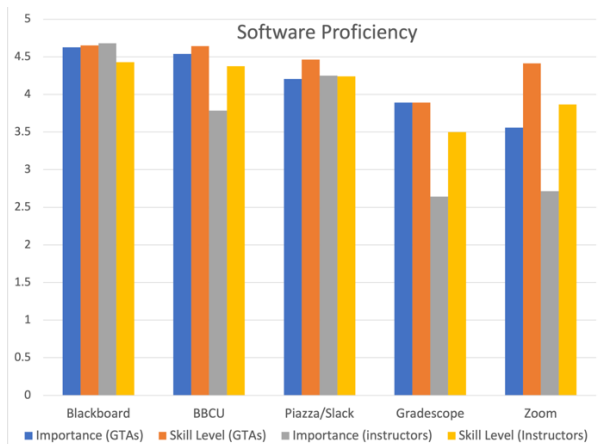


Figure 2: Average responses to survey questions focused on perceived importance and level of preparation for software skills

More variation was observed across the aspects considered and between instructors and GTAs for ratings of importance and skill level for software proficiency. The instructors and GTAs did identify the same software skill as most important. This most important skill is proficiency in Blackboard, the learning management system used by the institution. Of the remaining aspects, however, GTAs rated the importance of those corresponding to online teaching/learning (Blackboard Collaborate Ultra and Zoom) considerably higher than did faculty. This likely at least in part because the survey was given during a year in which nearly all instruction was taking place online. While most instructors have a longer-term perspective and would consider several years of history when rating the importance of various skills, most of the GTAs had served in the role for less than two years when completing the survey. It is interesting to note that GTAs also rated the importance of Gradescope (an online tool that streamlines grading) considerably higher than did faculty. One possible reason for this is that GTAs are spending much more time grading than are instructors and hence have more to gain from tools that improve grading efficiency. This also aligns with GTAs indicating that time management is the most challenging aspect of their job. Finally, our results show that software proficiency is the only area in which instructors generally rate GTAs' skill level as equal to or higher than importance. (Blackboard proficiency is the single exception.) This suggests that GTA training should focus on knowledge of materials and pedagogical/communication skills.

In addition to the elements discussed above, the GTA survey also asked respondents to rate the helpfulness of (1) several new elements that could be added to the training and (2) training activities and structures that would be helpful in the GTA role. Among the possible new elements to be included in training, GTAs expressed the most interest in learning to hold effective office hours, followed by effective online interaction with students and dealing with disruptive students. In terms of activities and training structures, GTAs indicated that they

avored short training sessions at the start of the semester, regular meetups with other GTAs, and an online discussion forum for GTAs. It should be noted that the other two items (short training sessions in the middle of the semester and observations of experienced GTAs or instructors) received average ratings above 3, so all elements were perceived as useful.

Thirteen of the 40 GTAs who completed the survey were new to the role, completing their first semester as a GTA. In general, new GTAs' responses to the survey questions followed similar trends to responses overall. One difference, however, was that new GTAs viewed the opportunity to sit in on the labs or lecture of experienced GTAs or professors as more valuable than did respondents in general.

Conclusions and Next Steps

Based on the results of the GTA and instructor surveys, the CS department in which this study took place has made several modifications to GTA training and has plans for additional larger-scale modifications in the coming year. In addition to the start-of-semester orientation and training, the department will follow up with focused training sessions during the first few weeks of the semester. The planned topics are (1) effective interaction with students in labs and office hours and (2) effective and efficient grading and relevant software tools. In addition, the department is considering a new model in which lab sections are larger but are staffed by two GTAs so that new GTAs can be paired with more experienced GTAs for ongoing mentoring and informal training.

To deepen our understanding of GTA perceptions of their preparation for the role and to provide more effective ongoing training, the department will continue to survey GTAs and instructors. In addition, we plan to collect feedback from GTAs about specific elements of the modified training, as well as ask continuing GTAs to reflect on how their training needs have evolved as they have gained experience.

References

- [1] S.E. DeChenne, L.G. Enochs, and M. Needham, "Science, Technology, Engineering, and Mathematics Graduate Teaching Assistants Teaching Self-Efficacy," *Journal of the Scholarship of Teaching and Learning*, Vol. 12, No. 4, December 2012.
- [2] C. Deacon, A. Hajek & H. Schulz, "Graduate teaching assistants' perceptions of teaching competencies required for work in undergraduate science labs," *International Journal of Science Education*, Aug. 2017.
- [3] Y. Cho, D.P. French, and S. Sohoni, "Need Assessment for Graduate Teaching Assistant Training: Identifying Important but under-Prepared Roles," in *Proceedings of the ASEE Midwest Section Annual Conference*, 2010.