

Preparing Future Biology Faculty: An Advanced Professional Development Program for Graduate Students

STEPHANIE A. LOCKWOOD,
AMANDA J. MILLER,
MEGHAN M. CROMIE

ABSTRACT

Formal professional development programs for biology graduate students interested in becoming faculty members have come far; however, programs that provide advanced teaching experience for seasoned graduate teaching assistants are scarce. We outline an advanced program that focuses on further training of graduate teaching assistants in pedagogy and mentoring opportunities within a biology department. The Graduate Teaching Scholars Program provides opportunities for individualized instruction and learning while working with a faculty mentor. Graduate teaching scholars attend workshops, have their teaching evaluated, and serve as mentors for new graduate teaching assistants in the department. Students in the program are able to contribute to departmental education initiatives while growing professionally as teachers and future faculty.

Key Words: Graduate teaching assistant; TA training; faculty preparation; mentoring; teaching evaluation.

Graduate students in biology departments are asked to wear many hats along with their lab coats. This can be a shock to new students who are not prepared for the diverse responsibilities of graduate life. In addition to coursework and research, a majority of graduate students also face the challenge of working as graduate teaching assistants (GTAs). At most research-based institutions, emphasis is placed on research and publication; teaching and teacher preparedness are generally afterthoughts (Luft et al., 2004; DeChenne, 2010). This commonly accepted practice not only shapes graduate students' opinions about teaching but can also create an atmosphere that conveys to undergraduate students that their education is not as important as research (Pushkin, 2008).

Thankfully, there is a current shift away from the attitude that "teaching is not important," as more GTA training courses are being put into place, both in the United States (Rushin et al., 1997; Harris & McEwen, 2009; Dotger, 2010) and internationally (Hanbury et al., 2008; Chadha, 2013). These training courses are often preservice

or during the first semester, department-specific, and supplement the trainings on policies and procedures required by most universities. Unlike for secondary science teachers, who are required to have 24–30 university teaching credits for their degrees, there is no standard for postsecondary teacher training. Current programs range from half-day workshops to semester-long courses (Rushin et al., 1997). Training can cover a variety of topics, including teacher readiness, teaching strategies, classroom management, and pedagogy. Training GTAs is essential for many reasons, including reducing classroom anxiety, increasing leadership capabilities, and increasing confidence and readiness both in the classroom and in research (Nurrenbern et al., 1999; Roach, 2003). Courses that cover basic teaching skills combined with GTAs' intuition, motivation, and general aptitude for teaching give graduate students an advantage as they move forward in their academic careers (Kenney, 2007).

Although the field of GTA training and education has come far, for seasoned GTAs, programs that provide a layer of additional teacher training beyond introductory teaching workshops or courses are scarce (Rushin et al., 1997). Here, we seek to address this gap by describing one such program at a public research university, which fosters an appreciation for outstanding GTAs by allowing them to expand their skill set individually.

○ Graduate Teaching Scholar Program

The Graduate Teaching Scholar (GTS) Program in Texas Tech University's Howard Hughes Medical Institute Science Education Program at the Center for Integration of STEM Education and Research (TTU/HHMI @ CISER) emphasized graduate-student interaction with outstanding teaching-faculty mentors, with the objective of producing the next generation of high-quality university teachers. Graduate teaching scholars (GTSs) were selected through an application and interview process, which included a written essay, a recommendation letter from their

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faculty advisor, and a panel interview with the program's directors. This two-semester professional development program paired experienced GTAs with expert biology-faculty mentors to provide individualized advanced teaching development and practice (Table 1). This experience was unique for each GTS and included the development and teaching of curriculum for undergraduate lecture courses,

evaluation, and assessment of teaching abilities by expert faculty, and presentations at regional and national education conferences. The GTS Program also included opportunities to serve on a departmental project committee and to be peer mentors for a GTA training course required for new GTAs. The GTS Program partnered with the university teaching center, departmental faculty teaching mentors, and the departmental graduate teaching program and consisted of the following components (Figure 1): professional development workshops, teaching evaluations, faculty mentoring, lecture teaching experience, peer-mentoring, and the opportunity to participate in departmental teaching projects.

Table 1. Goals and objectives of two professional teaching development plans developed by GTS Program students and their faculty mentors. The tailored plans allowed GTS students to focus on their own individual teaching needs.

Sample 1 (Miller)	Sample 2 (Cromie)
1. Strengthen ability to convey material to a large class of undergraduate students (Organic Evolution).	1. Incorporate active-learning techniques when teaching a Human Physiology discussion section to over 100 students.
2. Develop and implement assessment techniques such as quizzes, assignments, and tests.	2. Implementation of social media in Human Anatomy lab.
3. Learn to effectively use clickers as a teaching tool in a large lecture-style setting.	3. Become more comfortable with teaching, more specifically, lecturing large classes.
4. Plan and teach 2–3 units, consisting of 2–3 lectures each.	
5. Encourage students to actively participate in class through Q&A and discussion.	



Figure 1. Overview of the Graduate Teaching Scholar (GTS) Program, which utilizes campus and department resources to allow GTS students to work with teaching experts from within and outside the department. The GTS Program has six components designed to allow GTS students to expand their teaching skills beyond the typical training of graduate teaching assistants.

One of the authors (Lockwood) is a TTU/HHMI @ CISER Postdoctoral Teaching Scholar, developer and instructor of Biological Pedagogy (teaching course for new GTAs), and works closely with both the GTSs and new GTAs in the department. Two of the remaining authors (Miller and Cromie) had the opportunity to participate in the GTS Program, so they share their inside perspectives on the benefits of such a program in preparing them to become future biology faculty. Here, we describe the different components of the GTS Program.

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1. University Teaching Center

The GTS Program utilizes Texas Tech University's Teaching, Learning and Professional Development Center (TLPDC) for the professional development workshops and the teaching evaluations (Figure 1). Training with professional educators is an essential component of faculty development programs (Wilson et al., 2010). While ongoing professional development is required of elementary/secondary school teachers (Hawkey, 1998), most training classes offered in higher education are voluntary, with little incentive for attendance. University teaching and learning centers are becoming quite common on campuses nationwide and offer development workshops and courses for university graduate students and faculty (Challis et al., 2009; D'Avanzo, 2009).

Professional Development Workshops. To foster a culture of ongoing professional development, GTSs were required to take 6 to 9 hours of professional development workshops from the TLPDC over the academic year, which were reported in the GTSs annual report. The TLPDC offers more than 30 workshops each semester, and the GTSs were allowed to select the ones they wished to attend. These workshops span a variety of topics: professional demeanor, student learning, course development, and preparation for application to faculty positions. Workshops provide an invaluable resource for teaching development, as well as the benefit of networking. During workshops, GTS students were able

to establish relationships with TLPDC staff members and faculty campus-wide. This helped to cultivate an atmosphere of campus-wide support in promoting teaching enhancement.

Teaching Evaluation. Svinicki and McKeachie (2010) suggest that beginning teachers quickly form lasting styles and attitudes about teaching. To encourage the development of positive teaching styles and attitudes, the GTs had their teaching assessed by the TLPDC. Each scholar prepared a 30-minute lecture to present to a TLPDC staff member, faculty mentors, and students in attendance. The lecture was videotaped and formatively assessed by the TLPDC staff. The GTs received a copy of the video and an evaluation of their teaching.

The TLPDC used an instructional observation form based on Weimer et al.'s "Made-To-Order Form for Instructional Observation" (1988). The form used the following scale: "Observed and done well, Needs discussion, or Not observed on this day" for more than 50 observable instructional behaviors in the following categories: organization, presentation, rapport, interaction, and content. The form also contained sections for qualitative comments about overall strengths and suggestions, which the TLPDC used for written feedback, as well as references for additional information. This reflective process allowed the scholars to gain a new perspective and to critically think about their classroom teaching and management decisions.

2. Departmental Faculty

Collaborating one-on-one with a dedicated faculty member to improve teaching engages students and supports intrinsic motivation and higher self-efficacy (Prieto & Meyers, 1999). Department faculty members were utilized in the GTS Program to provide teacher mentoring and to provide GTs with lecture experience within the mentor's classroom (Figure 1). All faculty mentors were approved by the program's directors (members of the university's Teaching Academy). Most faculty mentors have received numerous university teaching awards and have been inducted into the university's Teaching Academy.

Faculty Mentoring. Each GTs was paired with a faculty mentor, usually the student's research advisor or lab/discussion coordinator. Faculty mentors worked with GTs to create a professional teaching development plan (Table 1). The plan allowed GTs to be personally responsible for their involvement in the program, while providing an instrument for the faculty mentor to track student progress throughout the year. The established plan's goals and objectives challenged the GTs to go beyond the normal GTA roles and incorporate their newly obtained skills (active learning, classroom assessment techniques, etc.) gained during the TLPDC workshops into their teaching. By setting attainable individual goals, the program can be successfully tailored to the needs of each GTs, thus allowing GTs to work on their individual strengths and weaknesses to be more effective in the classroom.

Lecture Teaching Experience. Lectures remain a dominant approach to teaching, despite the shift away from teacher-centered lectures to more active-learning classrooms (Svinicki & McKeachie, 2010). Although graduate students in the sciences will pursue careers in academia, many will graduate without a single hour of lecture-style teaching experience (Rushin et al., 1997). It is expected that those interested in becoming faculty at the university level will gain experience during a postdoctoral fellowship, but teaching may not be emphasized even at this stage. At our institution, most GTAs are

appointed positions teaching laboratory or discussion sections and have little interaction with teaching student-centered lectures or traditional lecture-style courses.

Students in the GTS Program teach in a lecture classroom for at least two class periods. Experience teaching in a traditional biology classroom setting can proactively alleviate some of the anxiety that new faculty feel when lecturing large classrooms for the first time (Roach, 2003). During the GTs' lectures, the faculty members made required observations and provided constructive feedback. Classroom observations are an essential component of faculty and teacher development and provide the opportunity to reflect on teaching through the eyes of another (Weston & McAlpine, 1999). The extent of lecture development and teaching varied for each GTs, but the overall goal of providing experience in a lecture classroom remained the same. Traditionally, GTAs are given predesigned laboratory and discussion materials with minimal allowance for modifying content; therefore, preparing and organizing classroom lectures was a new and valuable experience for many scholars.

For the GTs, the primary goal of lecturing was learning to effectively communicate content to students and to incite interest and excitement about the material. To achieve this, each GTs used personal experience and incorporated pedagogical skills learned during TLPDC workshops and mentoring sessions. For example, one of the authors (Cromie) began each of her lectures discussing the learning objectives for the session using key words from *Bloom's Taxonomy* (Anderson et al., 2001). These objectives helped the GTs develop a structure and format for the class and facilitate learning by giving a preview of the lecture.

The experience of teaching in a large, lecture-style classroom provided many opportunities to practice aspects of teaching not generally seen in preformatted laboratory and discussion sections. The GTs were challenged to encourage student participation and discussion even while addressing misconceptions and questions. With a majority of the scholars interested in pursuing a career in academia at the university level, the program provided GTs with a foundation of tools, strategies, and experience to become successful lecturers.

3. Department Graduate Program

Preservice and early-service teacher mentoring programs are widely used in training and preparation of K–12 teachers (Freedman & Appleman, 2009). Although universities recognize the merit of a mentor relationship akin to that of the research advisor, most do not address the need for a mentor where teaching is concerned. One way to increase GTAs' teaching effectiveness is to tailor a teaching program to the needs and specific content for which GTAs will be responsible (Luft et al., 2004; Cho et al., 2010; Dotger, 2010). The Biological Pedagogy course was designed (by Lockwood) to incorporate the use of experienced GTAs as mentors for new GTAs in the department to encourage the development of a positive teaching community (Figure 1).

Graduate Teaching Scholars as Peer Mentors. Experienced GTs were paired with new GTAs taking Biological Pedagogy as teaching peer mentors to foster positive teaching styles and attitudes, as suggested by Svinicki and McKeachie (2010). The GTs mentors help develop the teaching abilities of their GTA mentees, just as their faculty mentors helped them. Boyle and Boice (1998) suggested that involvement in a well-developed systematic mentoring program

appears to be very important in aiding teacher development. The mentorship component is designed to provide new GTAs with a peer-supported teaching framework. Mentors guide new GTAs through a series of reflective teaching exercises designed to help new GTAs think about their classroom decisions. Mentors meet regularly with the GTAs to provide continual support during their first semester. In addition to the individualized mentoring opportunities, GTAs also participate in the discussion portion of the course, which allow GTAs to continue developing their individual teaching philosophies while providing an experienced perspective in the discussions.

Effective communication between new GTAs and their mentors is an essential part of the mentoring process. This process can be standardized across the program using proper mentor training as well as observation and reporting form (Center for Teaching and Learning, 1994; Pfund et al., 2006). To ensure that GTAs were adequately trained as peer-mentors, they participated in a specialized mentoring workshop given by several members of the TLPDC. This workshop focused on listening effectively, giving constructive criticism and support, and prioritizing identified topics for discussion. During the mentorship workshop, mentors were given the instructional evaluation form used by the TLPDC and taught how to use it to evaluate the teaching of their mentees. During the course, GTAs also attended a guest lecture on reflective teaching given by the TLPDC. This lecture provided both mentors and mentees a foundation for reflecting on their own and others' teaching. This program provided the GTAs experience as peer-mentors, as well as an opportunity for continual growth and development of themselves as future faculty members.

Teaching Scholars Project Committee. The Teaching Scholars Project Committee, created by the GTAs, met once a month and worked on various projects that contributed to the educational betterment of the department. The group met to talk about teaching issues that were important to them and their fellow graduate students in the department. During the authors' involvement, the committee worked on two separate projects: redesigning the department's student evaluation form for GTAs and writing an NSF Science, Technology, Engineering, and Mathematics Expansion Program (STEP) grant. As a result of the student evaluation committee, the department now employs a new student evaluation form that provides more constructive feedback for all biology GTAs.

○ Program Evaluation

In order for a program to continue to meet the needs of its audience, it must constantly be evaluated and updated (Cho et al., 2010). During the final semester of the program, GTAs were asked to reflect on their experiences and fill out an annual report describing their achievements and outcomes. Many of the questions on the report asked the students to address whether or not the goals set by the student and faculty mentor were achieved, and in what ways the faculty mentor contributed to the successful achievement of these goals. The evaluation also asked students to list the workshops attended at the TLPDC and reflect on the topics that they found most helpful for faculty development. The GTAs were asked to provide qualitative, constructive feedback (for internal use; no institutional review board) on the annual report, concerning their thoughts and opinions about the program and how it could be further improved for future cohorts of students.

As participants in the program, two of the authors were given the opportunity to directly provide feedback. One author (Miller) believed that as a whole, the program helped her become a better teacher simply by exposing her to more of the realities and difficulties of teaching lecture-style courses. From a broader perspective, the program provided an opportunity to interact with faculty, staff, and administrators across campus in a more professional context. She enjoyed brainstorming with other students and developing projects and programs that will help better the institution as a whole. As a mentor to new GTAs, she appreciated the opportunity to discuss teaching techniques with novice teachers and share what she learned during her experiences. The program provided the other author (Cromie) with the necessary experience and teaching pedagogy to significantly improve her confidence in the classroom as well as enhance her ability to teach to the different learning styles in the classroom. Based on her experience, she strongly believes that more graduate and undergraduate students could benefit from the implementation of similar programs.

Writing their feedback on the program gave the GTAs an opportunity to reflect on improvements made in the classroom with the guidance of faculty mentors. The opportunity for reflection allowed students to recall where they were at the beginning of the GTS Program and realize their growth as educators. Having a chance to express opinions about the overall efficacy of the program and improvements that could be made gave GTAs the power to help shape the program in the future. The GTS Program can greatly benefit from the perspectives of the scholars and faculty. Feedback from program participants is absolutely critical for any program to achieve its full potential.

○ Conclusion

The Graduate Teaching Scholars Program offers a unique opportunity for graduate students in biology to gain advanced experience as teachers and lecturers. This program provides a tremendous opportunity for those students accepted; however, it requires a major time commitment from scholars. Therefore, a scholarship through TTU/HHMI @ CISER is provided to those students who are awarded a position as a GTS. This scholarship promotes involvement and ensures that graduate students are being compensated for their time and effort. Upon completion of the program, a majority of the scholars found the experience to be helpful in contributing to the advancement of their teaching. Through the workshops at the TLPDC, lecture teaching experience, committee involvement, and mentoring opportunities, the GTS Program allowed graduate students to be involved in many aspects of faculty development and service. These experiences are invaluable and provide a window into the future duties and responsibilities that new faculty members face. The experiences gained within the program greatly enhance the quality of current graduate assistant teaching in the department, which contributes to undergraduate student retention (O'Neal et al., 2007) and prepares graduate students as future faculty (National Science Board, 2010; AAAS, 2011).

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- STEPHANIE A. LOCKWOOD is a postdoctoral Teaching Fellow in Biology at Texas Tech University, MS 43131, Lubbock, TX 79409; e-mail: stephanie.lockwood@ttu.edu. AMANDA J. MILLER is 4-H AgriLife Extension Services Coordinator at Texas A&M, 1600 B Smith Rd., Austin, TX 78721; e-mail: amanda.miller@co.travis.tx.us. MEGHAN M. CROMIE is a Graduate Research Assistant in Biology at Texas Tech University, MS 41163, Lubbock, TX 79409; e-mail: meghan.cromie@ttu.edu.