Professional Development in College Science Teaching

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PROFESSIONAL DEVELOPMENT IN COLLEGE SCIENCE TEACHING

by

Aimée Kathryn Thomas

Abstract of a Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

May 2010
Graduate students earning a doctorate in the sciences historically focus their work on research and not professional development in college science teaching. However, for those who go on to a career in academia, a majority of their time will be dedicated to teaching. During the past few years, graduate teaching assistants (GTAs) have been prepared to teach by attending a daylong workshop that included logistical information, but left pedagogy largely unexplored. Since that time, a seminar has been added to provide an introduction to pedagogical theory and practices and to provide practice teaching in the biological sciences laboratory course. Yet, more pedagogical preparation is needed.

This study was conducted to determine if there was a need for a teaching certificate program for doctoral students in the College of Science and Technology (CoST) at The University of Southern Mississippi. The GTA respondents studied set teaching goals that were consistent with faculty members across the country; however, this research went further by finding out how competent the GTAs perceived they were and how much support they perceived they needed with respect to teaching and professional development. The GTAs did not differ in their perceived level of competence based on experience level; however, the less experienced GTAs did perceive they needed more support than the experienced GTAs.

To help GTAs develop a skill set that many CoST graduates currently lack, it is recommended that the University provide ample training and supervision. Establishing a
certificate program can potentially impact the community in the following ways: 1) the training of GTAs contributes to the academic preparation of future academic professionals who will be teaching in various institutions; 2) GTA training provides professional development and awareness that teaching requires life long professional development; 3) ensuring competent academicians, not only in content but also in pedagogy; 4) GTAs can encourage or incite undergraduates’ interest to choose a career in the sciences; and 5) make our graduates more marketable. Since 68% of current GTAs were interested in a teaching position, the University should allocate time to educate the GTAs who are currently teaching or plan to teach as a profession.
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Approved:

Dean of the Graduate School

May 2010
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CHAPTER I

INTRODUCTION

Professional Development in College Science Teaching

“To account for classroom anomalies, it is sometimes wryly noted that college teaching is the only profession requiring no formal training of its practitioners. Strictly speaking, this is true, but in fact most persons who make careers of college and university teaching have undergone some kind of apprenticeship. This apprenticeship, at least in recent years, is typically a teaching assistantship undertaken while the participant is getting his terminal degree in graduate school.” Logan Wilson, President American Council on Education, 1968

The practice of providing training for graduate teaching assistants (GTAs) joining the academic professoriate has support from two federal agencies, namely, the National Research Council (NRC) and the National Science Foundation (NSF), one private organization, the Pew Charitable Trusts, and the national group Association of American Colleges and Universities (AAC&U). The report of the National Research Council on Transforming Undergraduate Education in Science, Mathematics, Engineering and Technology (1999) emphasizes the role of postsecondary institutions in providing quality experiences that encourage graduate and postdoctoral students to become skilled teachers by acquiring additional knowledge about how teaching methods affect student learning. Moreover, the NSF continues to support undergraduate science education through programs in the Division of Undergraduate Education, which generally involve graduate teaching assistants’ critical role in improving introductory science courses. A number of
universities in the southeast United States conduct GTA workshops, institutes, and some even offer a mandatory course for credit as preparation in teaching science laboratories through certificate programs. Among the southeastern universities with formal programs for GTAs are North Carolina State University (“Certificate of Accomplishment in Teaching,” 2009), University of Georgia (“Teaching Assistant Support,” 2009), Emory University (“Teaching Assistant Training,” 2009), University of Alabama (“Workshop for New,” 2009), and Florida State University (“PIE Fall Teaching,” 2009). Some of these programs are described in detail in Chapter II.

Graduate students hoping to obtain a Master’s or Doctoral degree in the sciences often receive teaching assistantships to fund their work. For the assistantship, they usually teach two or three laboratories in their respective discipline. Historically a science graduate degree has provided training in research practices, techniques and tools; however, students have not received any formal training in college science teaching (Hainline, 2001). While many graduates will not continue in a career that incorporates teaching, many others will.

Background of the Study

Prior to this study, faculty within the Department of Biological Sciences developed a teaching assistant workshop (in 1998) for undergraduate and graduate students who would teach a laboratory during the upcoming academic year (see Appendix A). The one-day workshop is conducted a week prior to the beginning of fall classes. Workshop topics include teaching assistant expectations, getting ready for a class (syllabus and lab preparation), guidelines for effective teaching, laboratory safety, fire safety, cheating and student confrontation, classroom management, sexual
harassment, disability issues, grading, teaching assistant evaluations, departmental resources, and diversity in the classroom. However, after several years of hosting the workshop, the content still lacked pedagogical training. Therefore, a Professional Development for Graduate Teaching Assistants seminar designed to prepare graduate students to teach laboratories in the biological sciences was institutionalized. Started in the fall of 2004, this one-credit hour course was given a new catalog number (BSC 600) and named, Professional Development for Graduate Teaching Assistants. The seminar includes the workshop and four subsequent meetings to teach pedagogical theory and practices and to provide practice teaching in the biological sciences laboratory courses (See Appendix B for course syllabus and agenda). Graduate teaching assistants are now required to attend the workshop every fall semester, although only first year GTAs participate in the seminar course during their first fall semester. The course consists of two parts: (1) an eight-hour workshop held at the beginning of the fall semester and (2) a series of four two-hour seminars throughout the fall semester. The main information used for the course comes from several sources including Classroom Assessment Techniques by Angelo and Cross (1993), Science Educators Guide to Laboratory Assessment by Doran, Chan, Tamir, & Lenhardt (2002) and Teaching Tips by McKeachie (2002). Current articles published in scientific journals are provided when deemed appropriate and applicable to the nature of the topic.

The workshop program consists of presentations on investigative methods of instruction, effective use of technology, understanding how people learn, and classroom assessment techniques. Graduate teaching assistants are divided into teams to role-play possible scenarios and methods for establishing rules and procedures in the laboratory,
observing safety in the laboratory, resolving conflicts, and other social issues. Invited
speakers provide information on university policies regarding sexual harassment,
disability compliance, equal opportunity, and ethical issues. Case studies on these issues
are also presented to provide practice for the GTAs.

For those enrolled in the seminar course, i.e., BSC 600, four subsequent seminars
are then conducted during the fall semester. The facilitators use immersion when
teaching, following the guidelines for that particular methodology while instructing the
GTAs. Each seminar has a theme. The first seminar’s theme is “Teaching for Meaningful
Learning.” During this seminar the various methods of teaching investigative laboratories
such as problem-based laboratory, project-based laboratory, guided inquiry, open-ended
inquiry, teacher-collaboration inquiry, and the use of educational technologies are
presented. The constructivist perspective and cooperative learning principles and
typologies are also discussed. Finally, conceptual change is demonstrated by identifying
misconceptions, constructing concept maps and teaching metacognition.

The second theme is “Classroom Assessment.” The book, Classroom Assessment
Techniques: A Handbook for College Teachers (Angelo & Cross, 1993) and Teaching
Tips: Strategies, research, and theory for college and university teachers (McKeachie,
2002) are used to guide the GTAs in developing assessment techniques to assess course-
related knowledge, skills, and attitudes. Exercises to develop performance-based
assessments and rubrics on selected concepts are included. Finally, the role of evaluation
in grading is discussed.

The third theme, “Developing Plans for Instructional Improvement” includes the
following activities: (1) classifying traditional and investigative laboratory exercises from
the laboratory manual used in the course assigned to teaching assistants, (2) transforming a traditional laboratory activity into an investigative one, and (3) developing a rubric to assess student learning in the transformed activity. Rubrics produced for the USM Quality Enhancement Plan program are provided as samples (see http://www.usm.edu/qep/).

The fourth theme, “Implementation of Instructional Plan”, consists of presentations of transformed laboratory activities and accompanying rubrics by the GTAs. The presentations are evaluated using the checklist of Elements of Inquiry adapted by the author from Inquiry and the National Science Education Standards (NRC 2000).

The teaching methods used during the seminars are demonstrations of the various methods of investigative and constructivist teaching techniques, problem-solving using discrepant events, role-playing, simulation of classroom scenarios and lecture-discussion. Through this seminar, the impact of the course on teaching assistants’ method of instruction, preparation for teaching, and attitudes toward science teaching are assessed.

Biological Sciences is one of the University’s largest academic units with nearly 800 majors. Most of the University’s undergraduates satisfy their General Education Core laboratory science requirement by enrolling in introductory biology courses. Each academic year, as many as 100 science majors’ labs with an approximate enrollment of 2,000 students and 72 non-science majors’ labs with an approximate enrollment of 1,400 students are offered. Most of these labs are taught by GTAs. Therefore, the potential impact this seminar has on the student population each year could be tremendous (nearly 3,400 students or approximately 25% of the student population on the Hattiesburg campus).
Statement of the Problem

Based on a survey conducted by Golde and Dore and published in Paths to the Professoriate in 2004, 63% of the graduate students surveyed were interested in a faculty job in the future. Of the three areas of the professoriate, graduate students replied that they were best prepared for a role as a researcher, rather than a teacher or for conducting any type of service activities. Of the prospective faculty who responded to the survey, 74.2% were interested in conducting research, 71.7% were confident in their abilities and 65.1% thought their Ph.D. program had prepared them for this. However, only 42.9% reported being prepared to publish, but 52.4% were confident that they could so, even if their programs did not prepare them effectively. While the focus of a Ph.D. degree is on conducting research, according to a study published in 1999 by the Higher Education Research Institute, on average, faculty spend 59% of their time teaching, 23% of their time on service and other administrative obligations and only 18% of their time on research and scholarship (Golde & Dore, 2004).

This study also found that 83.2% of the graduate students who responded expressed a desire to teach as their motive for becoming a professor. More than half of the graduate students surveyed (53.6%, but much higher in the sciences, 83.8%) had been required to serve as a teaching assistant. Only 49.8% of the graduate students reported that additional learning opportunities (for teaching) were available. Of the graduate students interested in being a faculty member, 57.9% reported being “very prepared” to lead discussion groups, 44.7% of the science students were prepared to teach laboratories and only 36.1% were prepared to teach lecture courses. The authors were alarmed by these low percentages because these are typically jobs performed by doctoral teaching
assistants. Golde and Dore (2004) also measured the graduate student’s preparation for service. While greater than 50% of the students expressed a high desire to be involved in service opportunities, few students’ programs afforded opportunity to be trained in service roles and thus this aspect was not discussed further in the study (Golde & Dore, 2004).

As their future role as members of the professoriate, graduate students will have to not only fulfill the requirement of conducting novel research, but also teach courses, and provide service to the community. As graduate students in the sciences, the basis of the Ph.D. is to learn how to conduct research. Therefore, much effort is put into developing this technique in graduate students. In addition, there are ample opportunities for graduate students to learn about doing service, including judging science fairs, community outreach, summer camps, graduate student forum activities and Science Olympiad, to name a few. Thus, what is lacking is in other areas of professional development, including teaching preparation, grant procurement, manuscript development and development of presentations to be delivered at professional meetings. Each of these tasks is essential to being a successful member of the professoriate, yet there is little to no formal training for this. Graduate students typically have to gain experience by doing and hopefully be mentored along the way. The “learn by doing” approach, would be enhanced if graduate students were provided with training workshops and practice.

The Department of Biological Sciences implemented a graduate teaching assistant workshop (see Appendix A) and institutionalized a one-hour seminar course that guides GTAs in their respective teaching assignments (see Appendix B for course syllabus and
agenda). The students attend a day-long workshop and four subsequent two-hour seminar sessions and complete assignments associated with their readings on current topics in teaching. They are required to actively participate in group discussions on various topics and to collaborate and complete projects with other students. However, more is needed to prepare the future professoriate. Therefore, the researcher surveyed current GTAs to collect data to determine if the workshop and other various training has been effective in their preparation to teach. The researcher will use the data compiled to develop a teaching certificate program for doctoral students in the College of Science and Technology, thus making USM graduates more marketable as they attempt to join the ranks of the professoriate.

Purpose of the Study

The purpose of this study is to establish the justification for a teaching certificate program in professional development for doctoral students who plan a career in the professoriate. Doctoral students are trained to effectively conduct research (Hainline, 2001) and do service, yet there are not many resources readily available to train them to teach, which will be a major part of their tenure if they pursue a career at a higher education institution. Training future faculty will have great impacts on future Science Technology Engineering and Mathematics (STEM) students at universities across the country, as well as the faculty themselves. Establishing a certificate program will make our graduates more prepared to join the rank of the professoriate and thus, more marketable to other institutions of higher learning.
Justification of the Study

While science departments are likely to have an inherent need for graduate teaching assistants, and thus provide the GTAs with teaching experience, most teaching assistant training programs, including the one developed by faculty in the Department Biological Sciences, still lacks much of the pedagogical training necessary to be an exemplary teacher (Tanner & Allen, 2006). The benefit of establishing this certificate program will have the following potential impact on our community:

1. The training of graduate teaching assistants contributes to the academic preparation of future academic professionals who will be teaching in various institutions;
2. Graduate teaching assistant training provides professional development and awareness that teaching requires life long professional development;
3. Ensures competent teaching staff, not only in content but also in pedagogy; and
4. Finally, and perhaps the most important, the graduate teaching assistants can encourage or incite undergraduates’ interest to choose a career in the sciences.

Research Questions

1. What are the graduate teaching assistants’ goals for teaching?
   a. Are the graduate teaching assistants’ goals for teaching different based on level of experience?
2. What pedagogical education and supervision do the graduate teaching assistants receive?
3. What is the perceived level of competence of graduate teaching assistants in teaching and professional development?
a. Are the perceived levels of competence of graduate teaching assistants in teaching and professional development different based on level of experience?

4. How much support do the graduate teaching assistants perceive they need in teaching and professional development?

a. Is the support that graduate teaching assistants perceive they need in teaching and professional development different based on level of experience?

Graduate teaching assistants were grouped based on their level of teaching experience as follows: 0 experience, 1 – 4 semesters teaching experience, >4 semesters teaching experience.

Delimitations

• Participation in the study was voluntary.

• Participation was limited to graduate students enrolled at The University of Southern Mississippi.

• Questionnaires, reflection questions and interviews were conducted during the fall of 2009.

• Questionnaires, reflection questions and interviews were conducted by email, mail, and face-to-face.

Limitations

• The researcher had no control over honesty or accuracy.

• The pool of subjects was small.

Assumptions

• Participants answered the questionnaire, reflection questions, and interview honestly.
CHAPTER II

REVIEW OF THE LITERATURE

“…college teaching is the only profession requiring no formal training of its practitioners” (Nowlis, Clark, & Rock, 1968, p.iii).

Scholarship Reconsidered

“Teachers who keep up with current developments, who devise better ways to help students learn, or who do research on methods of teaching are also scholars” (Boyer 1990). Thus, there is an increasing acceptance of the idea that good teaching involves much scholarly activity. Therefore, teaching enhances research and research enhances teaching.

According to Uno (1999), characteristics of excellent instructors include: 1) Being prepared and organized, 2) Being enthusiastic about teaching, 3) Presenting information clearly, 4) Being able to stimulate students’ thinking, 5) Being knowledgeable, and 6) Enjoying teaching and working with students. Characteristics of poor instructors include: 1) Arrogance, 2) Dullness, 3) Rigidity, 4) Insensitivity, 5) Vanity, 6) Self-indulgence, and 7) Hypocrisy.

The Trilogy – Research, Teaching, Service

Since the late 1980’s, there has been much attention devoted to studying the development of GTAs (Lumsden, 1993; Marincovich, Prostco, & Stout, 1998; Roehrig, Luft, Kurdziel, & Turner, 2003; Rushin, DeSaix, Lumsden, Streubel, Summers, & Bernson, 1997; Wulff, Austin & Associates, 2004) as evidenced by the number of publications dedicated to the topic. Entire volumes of journals have also focused on the need to provide training and supervision to GTAs (Andrews, 1985; Nyquist, Abbott, &
Historically, universities that have provided some training, have trained their GTAs by providing workshops prior to the beginning of the academic year. The subject matter taught at these workshops typically included procedural logistics that are non-discipline specific (Lucas, 2001; Nicklow, Marikunte, & Chevalier, 2007). This may include, but not limited to ethical considerations, sexual harassment, classroom discipline, disability issues, and campus resources. This type of information largely excludes discipline-specific topics and pedagogical practices, including teaching tips for the discipline. It also excludes laboratory teaching grading, multicultural learners and other topics that are important to cover to be effective teachers.

One of the reasons for the surge in attention to the pedagogical training and professional development of GTAs might be the concern that the restructuring and addition of new faculty in the late 1960’s is now seeing the retirement of large cohorts of faculty across the nation (Boyer, 1990). Thus, there has been a large influx of new professors hired nation-wide starting in the mid-1990’s due to the high number of retirements (Austin & Wulff, 2004; Finkelstein & Schuster, 2001). This foresight spun a new wave in funding for research to be conducted and programs to be established for preparing the future faculty. The NRC, NSF, The Pew Charitable Trusts and the AAC&U all supported this initiative by launching programs at the same time.

Preparing Future Faculty Initiative

The Preparing Future Faculty (PFF) program promotes professional development for doctoral students in the form of research, teaching and service. However, the focus of the program reaches beyond the scope of those main topics and delves into the realm of professional development to make the future faculty’s breadth of knowledge deeper.
This includes teaching the doctoral students about potential careers, mentoring and other realities associated with the professoriate. Launched in 1993 with funding provided by The Pew Charitable Trusts to the AAC&U, this program has graduated more than 4,000 “core participants” and many other occasional participants. The PFF “embodies” seven key ideas:

1. The doctoral experience should provide increasingly independent and varied teaching responsibilities as well as opportunities for prospective faculty to grow and develop as researchers;

2. The experience should help students begin to understand and appreciate elements of faculty service;

3. Doctoral students should learn about the academic profession through exposure to the range of professional responsibilities in the variety of institutions that may become their professional homes;

4. Doctoral programs should formalize a system for mentoring in all aspects of professional development;

5. Doctoral experiences should equip future faculty for the significant changes taking place in classrooms and curricula;

6. Professional development experiences should be thoughtfully integrated into the academic program and sequence of degree requirements;

7. Where high-quality teaching assistant orientation and development programs are available, PFF programs should build on them. (Pruitt-Logan & Gaff, 2004, p.179)
The PFF initiative has been through four phases of funding and has been a collaborative effort of institutions throughout the United States. Phase 1 funded 17 lead institutions and 68 institutional partners. Phase 2 was implemented to help institutionalize the established programs and to encourage other institutions to do the same. Phase 2 funded 15 lead institutions and 119 institutional partners. Phase 3 was funded by the NSF in collaboration with AAC&U and professional societies. It targeted disciplines within the sciences and funded 19 academic departments and 92 departmental partners. The fourth phase was funded by the Atlantic Philanthropies and incorporated disciplines in the humanities and social sciences. It funded 25 academic departments and 130 departmental partners. The grants were all completed in 2004 and most have been institutionalized with campus support (Pruitt-Logan & Gaff, 2004).

Re-envisioning the Ph.D.

The purpose of the Re-envisioning the Ph.D. initiative was to provoke continuous world-wide discussion on the question, “how can we re-envision the Ph.D. to meet the needs of society in the twenty-first century?” (Nyquist, Woodford & Rogers, 2004, p.194). The study, which was funded by The Pew Charitable Trusts and the Graduate School of the University of Washington, sought to identify who the Ph.D. stakeholders were by interviewing more than 400 academic and non-academic leaders, forming focus groups and E-mailing questionnaires. The participants included those that prepare, fund, hire and influence the doctoral enterprise (e.g., research extensive universities, business and industry and government funding agencies). This is unique since it includes feedback from non-educational entities with an interest in the development of Ph.D.’s. The research provided the following: a comprehensive Web site for doctoral stakeholders
to pose ideas and strategies, a bibliography dedicated to doctoral education, more than 300 “Promising Practices” compiled from 153 institutions (Promising Practices, 2009), a national conference, a collection of resources for help obtaining the degree and employment, access to more than 400 partnering institution Websites, and access to a dialogue discussion board online (Nyquist et al., 2004).

The following are a sample of the “Promising Practices” produced as a result of the Re-envisioning the Ph.D. initiative:

1. The University of Illinois at Urbana – Champaign established an advanced graduate teacher certificate which prepares teachers, mentors graduate students, and targets technology;

2. Michigan State University developed a certificate in teaching program which specializes in the preparation for teaching;

3. North Carolina State University also established a program to prepare teachers entitled, “Preparing the Professoriate”;  

4. The University of Georgia developed a mentoring and teacher preparation program named the “Teaching Support Seminar”; 

5. The University of Washington developed an annual spring meeting on GTA preparation (that is taught every May) to assist in the initial planning for GTA training in the fall; and

6. The University of North Carolina at Chapel Hill has a Center for Teaching and Learning, which focuses on the preparation for teaching by introducing topics that are important, such as planning, teaching strategies and evaluation (Promising Practices, 2009).
Professional Development Programs

Graduate Teaching Assistant Certificate Programs

The following are summaries of a few GTA certificate programs in the United States:

Michigan State University developed a certificate in teaching program that is optional for graduate students interested in a career in the professoriate. The University set a template of the requirements, but the units have the flexibility to fulfill them as deemed appropriate. There are coordinators of each program that work with the graduate students to individualize their requirements. To receive the certificate they must complete course work, core competencies, a mentored teaching experience and a teaching portfolio (“Certificate in College Teaching”, 2009).

The University of Illinois at Urbana-Champaign is similar to the Michigan State University program, but the certificate program also honors participants who make “exceptional contributions in classroom teaching, inquiry into teaching, and service related to teaching” (Advanced Graduate, 2000, ¶ 1). These are innovative programs and it wasn’t until the 1980’s that faculty across the nation starting discussing that this was a major problem that needed to be addressed.

Florida State University has several programs dedicated to preparing graduate students for a career in the professoriate. Their Preparing Future Faculty program is of particular interest since the culmination of the program results in a “Preparing Future Faculty Certificate of Completion”. The requirements include a mentorship with a faculty member, a portfolio with a curriculum vitae and teaching philosophy, teaching preparation and career building activities, such as job interviewing (Preparing Future Faculty, 2009).
Graduate Teaching Assistant Mentor Programs

The following are summaries of a few GTA mentor programs in the United States:

The University of Georgia has a mentor program that has been in place for almost 20 years. The graduate students who participate in the year-long program are experienced and considered outstanding teaching assistants. They are also planning for careers in the professoriate. This mentoring program is designed to prepare the graduate teaching assistants on what to expect in the role of a faculty member, to learn pedagogy of their particular discipline and involve the current faculty by serving as mentors to the aspiring academicians. The program also tracks the graduate students after they graduate and proceed in their respective careers (Center for Teaching and Learning, 2009).

North Carolina State University has a similar mentoring program called “Preparing the Professoriate” which is for graduate students who have already completed 18 hours of course work and have enough time to participate in a faculty teaching mentoring program. The program provides training workshops throughout the academic year to prepare the graduate teaching assistants for teaching at the college and/or university level (Preparing the Professoriate, 2009).

Graduate Teaching Assistant Training Programs

The following are summaries of a few GTA training programs at universities in the United States:

Emory University established a Teaching Assistant Training and Teaching Opportunity (TATTO) program that is a requirement for obtaining a Ph.D. The program is designed to ensure that every graduate is prepared in the “art of teaching”. The TATTO program occurs in four stages. The first stage consists of a three-day workshop
for all disciplines to learn how to write a syllabus, lecture, grade, utilize new technologies and other basic tools. The second is discipline-specific and focuses on teaching strategies and other tools. The third stage includes the initial teaching culminating in the actual teaching with a faculty mentor in the fourth stage. If the graduate teaching assistant demonstrates an exceptional ability in the classroom, they are eligible to apply for a Teaching Fellowship to teach one course one semester (Teaching Assistant Training, 2009).

The University of Tennessee developed a GTA mentoring program designed for providing professional development for future faculty. It was designed 15 years ago to produce teacher-scholars by providing graduate teaching assistants support in their teaching duties and providing professional development for graduate students. This includes discussing topics of interest, such as preparing to teach, motivating students, testing and grading, grant writing and funding. It also includes workshops devoted to ethical and legal issues and how to obtain an academic job (Promising Practices, 2009).

The University of Missouri – Columbia treats their program as a minor of study, called the “Interdisciplinary Graduate Minor in College Teaching”. It is a four-course sequence option for any Ph.D. student and includes a course on college teaching, professoriate and faculty roles, college teaching practicum and an elective in teaching or learning (Minor in College Teaching, 2009). They also offer a preparing future faculty program which includes a seminar course and professional development workshops.

Summary

As a result of many of the projects, researchers made recommendations for universities who were developing future faculty training programs. The
recommendations vary, but most conclude that the GTA training should be discipline specific so that they know how to effectively communicate to students within that field of study (Lucas, 2001; Nicklow et al., 2007). The teaching tips provided with the pedagogical training should also be discipline specific.

According to Austin and Wulff in their (2004) article “The challenge to prepare the next generation of faculty” is that future faculty will be expected to have a wide-range of research skills, including understanding the ethical issues related to research, technology skills, collaborative and communication skills, effective teaching skills, including understanding the teaching and learning process. Additionally, future faculty should have a good understanding of the current issues facing higher education while being a responsible institutional citizen. This includes understanding how service can most efficiently be tied into the academic realm of the institution. The future faculty must also be able to balance research with teaching and service.
CHAPTER III
METHODOLOGY

This chapter will discuss the research methodology, prior experience of the researcher, participants in the study, and research design. The instruments chosen will be described in detail as well as the statistical analyses that were performed.

The researcher designed the study to examine the following research questions:

1. What are the graduate teaching assistants’ goals for teaching?
   a. Are the graduate teaching assistants’ goals for teaching different based on level of experience?

2. What pedagogical education and supervision do the graduate teaching assistants receive?

3. What is the perceived level of competence of graduate teaching assistants in teaching and professional development?
   a. Are the perceived levels of competence of graduate teaching assistants in teaching and professional development different based on level of experience?

4. How much support do the graduate teaching assistants perceive they need in teaching and professional development?
   a. Is the support that graduate teaching assistants perceive they need in teaching and professional development different based on level of experience?

The researcher has previous experience with providing pedagogical education and supervision of GTAs as the coordinator of introductory biology laboratories for nine
years. In this capacity, the researcher has coordinated the teaching assistant workshop offered every fall, and provided supervision and guidance to the GTAs assigned to teach the introductory biology labs. The researcher has also worked with former Science Education colleague, Dr. Rosalina Hairston, to write, submit and administer an internal grant that provided support for the development of a Professional Development for Graduate Teaching Assistants seminar which began the fall of 2004. Several years prior to the seminar, colleagues in the Department of Biological Sciences developed a GTA workshop that was provided the week prior to the beginning of fall classes. It was a day-long event that included education on classroom management, sexual harassment, fire safety, and several other logistical concepts. However, the workshop lacked pedagogical training. Therefore, the researcher institutionalized a course and developed a handbook for the seminar that would guide all biology GTAs in their respective teaching assignments (Appendixes A, B and C).

The purpose of developing this seminar was to prepare graduate students in the biological sciences who would be responsible for instructing biology laboratories. Enrollment in the seminar includes the workshop, which is taught the week prior to the beginning of the fall semester, and four, two-hour seminar meetings. This is required of any student who will teach a biology lab during the academic year. The seminar includes instruction and practice teaching the biological sciences laboratory courses. Students who have attended the seminar in the past, but are still teaching during the academic year, must attend the workshop but not the seminar, although they are welcome to attend as many times as they would like. Graduate teaching assistants earn a one-hour pass/fail
credit for enrolling in the seminar course. A description of the workshop and seminar topics can be found in Appendices A, B and C.

Participants of the Study

The study participants included graduate students in the College of Science and Technology (CoST) at The University of Southern Mississippi who are or have been on a teaching assistantship. The research includes data collection of the participants’ teaching goals, level of teaching experience, perceived level of competence and perceived need for support in teaching and professional development. Demographic data were also collected. For the quantitative data collection, the distribution of questionnaires was administered by a biology colleague to the Biological Sciences and Chemistry/Biochemistry GTAs at the annual Teaching Assistant Workshop the week before the fall 2009 semester began. Graduate teaching assistants in other departments in the CoST had the instruments mailed to their supervisor, who then distributed them for the researcher. The questionnaires took approximately 20 minutes to complete. Since participation in the study was voluntary, the participants were provided the option to not take the questionnaire. Approval for this study was obtained from the Institutional Review Board at the University of Southern Mississippi (see Appendix H).

For the qualitative research, a small, nonrandom sample was chosen from the GTAs who volunteered to participate in this component of the research study. A purposeful sample is a common practice in qualitative research when trying to deeply understand the realities of a situation, in this case, teaching goals, perceived level of confidence and perceived need for support, and not necessarily what is generally true for all (Merriam, 1998). The researcher chose the six volunteer participants who represented
different levels of teaching experience so she could delve deeper into the participants’ teaching goals, perceived competence and perceived support needed to try to answer the research questions. The following is a description of the qualitative study participants:

1) Maggie was the most experienced GTA in the study with 12 semesters of teaching experience as a Master’s student. She taught the general botany laboratory;

2) Sam was the second most experienced GTA and has taught four semesters as a doctoral student and six semesters as a Master’s student, for a total of 10 semesters of teaching experience. She taught the comparative anatomy laboratory;

3) Melanie was the third most experienced GTA with six semesters of teaching experience as a Master’s student and two semesters as an undergraduate, for a total of eight semesters. She taught the first semester of general biology laboratory;

4) Jim has taught four semesters as an undergraduate. He taught the second semester of general chemistry laboratory;

5) Tina taught one semester as a Master’s student. She taught the first semester of general chemistry laboratory; and

6) Mandy had no teaching experience at all prior to this study. She taught the first semester of general chemistry laboratory.

During the fall 2009 semester, the qualitative participants each reflected upon their teaching and replied to a series of questions that were administered at three different times: 1) the night before they taught their first lab, 2) after they taught their first lab, and
3) at the mid-point of the semester. It took participants approximately 10 minutes to complete each reflection. Participants submitted these responses to the researcher via email. The researcher also conducted an interview with each participant at the end of the semester. Each interview lasted between 30 and 60 minutes and all were conducted in one of the freshman biology labs on the USM campus. Therefore, each participant devoted a total of approximately 60 to 90 minutes on the qualitative component of the research study.

The purpose of this study was to establish the need and provide justification for development of a certificate in teaching course series for graduate students seeking a career as an academician in the sciences. Since most institutions of higher learning do a good job of training doctoral students to effectively conduct research (as indicated in chapters I and II), they should also provide the resources necessary for graduate students to effectively learn how to teach. Training future faculty will have a critical impact on future STEM students at universities across the country, as well as the faculty themselves. Establishing a certificate program will make the USM graduates more prepared to join the rank of the professoriate and thus, more marketable to other institutions of higher learning.

Research Design

The researcher collected data using a mixed methods research design while incorporating some open-ended questions. The quantitative component of the study included three instruments: 1) a demographic questionnaire with open-ended questions, 2) the Teaching Goals Inventory of the GTAs (Angelo & Cross, 1993), and 3) the perceived level of competence on various teaching methods and professional
development topics, and the perceived level of support needed for each of the topics created based on a self-efficacy toward teaching instrument developed by Tollerud (1990) and adapted by Prieto and Altmaier (1994) and widely used by others (Nugent, Bradshaw & Kito, 1999; Prieto & Meyers, 1999). Self-efficacy is a measure of one’s belief in ability and measures the important variable of teacher effectiveness and consequent student achievement (Prieto & Altmaier, 1994; Soto & Goetz, 1998).

Comparisons of goals, perceived competence and need for support in teaching and professional development based on levels of teaching experience, including training and supervision, were analyzed. SPSS software was used to analyze the results of the questionnaires in relation to the experience levels of the GTAs. A multivariate analysis of variance (MANOVA) was conducted to test for significant differences in teaching goals, perceived competence and support by level of experience (divided into three groups: 0 experience, 1 to 4 semesters experience, and > 4 semesters experience). A MANOVA was chosen since the dependent variables (teaching goals, perceived level of competence and perceived need for support) are all similar in conceptual connotation. This is the preferred statistical test since any of these dependent variables are likely to influence or affect the participants in one way or another. A level of significance was set at ≤ .05.

The qualitative component of the study included a series of reflections and a follow-up interview (described below). For this longitudinal study, the participants responded to four questions the night before they taught their first laboratory for the semester. They then responded to four questions after they taught their first lab. Participants reflected on their teaching again at midterm by answering five questions and then the researcher interviewed each participant individually during the last week of the
semester. All responses were transcribed by the researcher and are presented in Chapter IV.

Instrumentation

_Teaching Goals Inventory_

The Teaching Goals Inventory (TGI) (see Appendix D) was written and developed by Angelo and Cross (1993). The 52 question survey was designed to provide a self-assessment of the participants’ goals for teaching based on what faculty think their students should achieve while enrolled in their courses. The TGI uses a horizontal numeric scale which consists of the following five choices: 1 = not applicable, 2 = unimportant, 3 = important, 4 = very important, and 5 = essential. The questions are arranged in six groups devised to help cluster common goals. The six emerging themes are: 1) higher-order thinking skills, 2) basic academic success skills, 3) discipline-specific knowledge and skills, 4) liberal arts and academic values, 5) work and career preparation, and 6) personal development. The TGI took participants approximately 10 minutes to complete.

The purpose of the TGI is to provide a self-assessment of teaching goals to help faculty set goals and have something to strive toward as a teacher. According to Angelo and Cross (1993), the first step in classroom assessment is to take inventory of the goals you have for teaching your students effectively. The TGI is self-scorable and was developed over several years of pilot testing. The foundation for the instrument was influenced by the Community College Goals Inventory, developed by researchers from the Educational Testing Services. The original study was conducted on faculty members at Miami-Dade Community College and published in Community/Junior College
Quarterly (Cross and Fideler, 1988). From 1986 until 1990, almost 5,000 college teachers provided feedback to the authors as they developed this instrument. The final version (used for this study) consists of six clusters of goals based on themes. Each cluster was tested for reliability (i.e., consistency) using Cronbach’s alpha and the results are presented in Table 1 (Angelo & Cross, 1993, p. 17).

Table 1

<table>
<thead>
<tr>
<th>Cluster Number</th>
<th>Cluster Name</th>
<th>Alpha Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Higher-Order Thinking Skills</td>
<td>(.77)</td>
</tr>
<tr>
<td>II</td>
<td>Basic Academic Success Skills</td>
<td>(.79)</td>
</tr>
<tr>
<td>II</td>
<td>Discipline-Specific Knowledge and Skills</td>
<td>(.71)</td>
</tr>
<tr>
<td>IV</td>
<td>Liberal Arts and Academic Values</td>
<td>(.84)</td>
</tr>
<tr>
<td>V</td>
<td>Work and Career Preparation</td>
<td>(.85)</td>
</tr>
<tr>
<td>VI</td>
<td>Personal Development</td>
<td>(.86)</td>
</tr>
</tbody>
</table>

Perceived level of Competence and Need for Support

The second instrument (Appendix E) was developed by the researcher based on several different instruments widely used in teaching development studies. This includes a questionnaire created based on a self-efficacy toward teaching instrument developed by Tollerud (1990) and adapted by Prieto and Altmaier (1994) and widely used by others (Nugent, Bradshaw & Kito, 1999; Prieto & Meyers, 1999). Self-efficacy is a measure of one’s belief in ability and measures the important variable of teacher effectiveness and consequent student achievement (Prieto & Altmaier, 1994; Soto & Goetz, 1998). The
perceived level of competence and need for support questionnaire focuses on how competent the GTAs think they are and how much support they think they need for teaching and for professional development. The instrument uses a horizontal numeric scale. Respondents were asked to read each item associated with teacher preparation and professional development and rate their level of competence for each based on the following scale: 1 = not very competent to 5 = very competent. They were then asked to rate their need for support using the following scale: 1 = low or little need to 5 = high or great need. This instrument took participants approximately 5 minutes to complete. Since this is a modified instrument, validation of the changes were made by a panel of experts (n = 5).

Demographic and Open-Ended Questions

A demographic questionnaire (Appendix F), including training and supervision questions, with questions pertaining to teaching and professional development was created by the researcher and was distributed to the participants. This took participants approximately 5 minutes to complete.

Reflection and Interview Questions

Reflection and interview questions (Appendix G) were developed to be consistent with the quantitative research instruments. Three sets of reflection questions were emailed to participants at different times during the semester. The questions were disseminated the night before teaching the first lab, the night after teaching the first lab and again at the midterm of the semester. Interviews were conducted during the last full week of the semester. Participants were asked to reflect upon the questions, write a response for each and email the responses back to the researcher.
The following questions were emailed to participants the night before teaching the first lab for the semester:

1. What are your teaching goals for the semester?
2. What concerns do you have about teaching [this course] this semester?
3. How confident are you in the content that you will teach tomorrow?
4. Describe what you did to prepare for teaching lab tomorrow.

The following questions were emailed to participants after teaching the first lab for the semester:

1. Do you think you will be able to accomplish your teaching goals for the semester? Explain.
2. Do you think you have the knowledge and skills necessary to effectively teach your course? Explain.
3. What type of support do you perceive you will need [if any] to effectively teach this course?
4. Were you well prepared to teach your course today? Explain.

The following questions were emailed to participants at the midterm of the semester:

1. What are your teaching goals for the semester? Have they changed since the beginning of the semester?
2. What concerns do you have about teaching [this course] this semester? Have they changed since the beginning of the semester?
3. How confident are you in the content that you have taught this semester and will teach the rest of the semester?
4. Describe how your preparation for teaching lab has changed since the first lab of the semester. If it hasn’t changed, speculate what you could do to be better prepared.

5. Have you received the support you have needed this semester to effectively teach the course?

Interviews were conducted with each individual participant and consisted of the researcher reviewing the responses from each cluster of reflection questions for the participant and then posing questions such as, what are you thinking now? When necessary, the researcher also encouraged respondents to elaborate on a comment that needed more explanation.

Summary

Table 2 summarizes the research instruments that were used to answer each of the following research questions:

1. What are the graduate teaching assistants’ goals for teaching?
   a. Are the graduate teaching assistants’ goals for teaching different based on level of experience?

2. What pedagogical education and supervision do the graduate teaching assistants receive?

3. What is the perceived level of competence of graduate teaching assistants in teaching and professional development?
   a. Are the perceived levels of competence of graduate teaching assistants in teaching and professional development different based on level of experience?
4. How much support do the graduate teaching assistants perceive they need in teaching and professional development?
   
a. Is the support that graduate teaching assistants perceive they need in teaching and professional development different based on level of experience?
<table>
<thead>
<tr>
<th>Research Question</th>
<th>Evidence*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What are the graduate teaching assistants’ goals for teaching?</td>
<td></td>
</tr>
<tr>
<td>a. Are the graduate teaching assistants’ goals for teaching different based on</td>
<td></td>
</tr>
<tr>
<td>level of experience?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teaching Goals Inventory (N=63)</td>
</tr>
<tr>
<td></td>
<td>Qualitative 1 Question 1 (N=6)</td>
</tr>
<tr>
<td></td>
<td>Qualitative 2 Question 1 (N=6)</td>
</tr>
<tr>
<td></td>
<td>Qualitative 3 Question 1 (N=6)</td>
</tr>
<tr>
<td></td>
<td>Interview (N=6)</td>
</tr>
<tr>
<td>2. What pedagogical education and supervision do the graduate teaching assistants receive?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demographic Questionnaire (N=63)</td>
</tr>
<tr>
<td>3. What is the perceived level of competence of graduate teaching assistants in teaching and professional development?</td>
<td></td>
</tr>
<tr>
<td>a. Are the perceived levels of competence of graduate teaching assistants in teaching and professional development different based on level of experience?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Competency Questionnaire (N=63)</td>
</tr>
<tr>
<td></td>
<td>Qualitative 1 Question 3 (N=6)</td>
</tr>
<tr>
<td></td>
<td>Qualitative 2 Question 2 (N=6)</td>
</tr>
<tr>
<td></td>
<td>Qualitative 3 Question 3 (N=6)</td>
</tr>
<tr>
<td></td>
<td>Interview (N=6)</td>
</tr>
<tr>
<td>4. How much support do the graduate teaching assistants perceive they need in teaching and professional development?</td>
<td></td>
</tr>
<tr>
<td>a. Is the support that graduate teaching assistants perceive they need in teaching and professional development different based on level of experience?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Support Questionnaire (N=63)</td>
</tr>
<tr>
<td></td>
<td>Qualitative 2 Question 3 (N=6)</td>
</tr>
<tr>
<td></td>
<td>Qualitative 3 Question 5 (N=6)</td>
</tr>
<tr>
<td></td>
<td>Interview (N=6)</td>
</tr>
</tbody>
</table>

* See appendices D – G for Research Instruments
CHAPTER IV

ANALYSIS OF DATA

This study was designed to answer the following research questions:

1. What are the graduate teaching assistants’ goals for teaching?
   a. Are the graduate teaching assistants’ goals for teaching different based on level of experience?

2. What pedagogical education and supervision do the graduate teaching assistants receive?

3. What is the perceived level of competence of graduate teaching assistants in teaching and professional development?
   a. Are the perceived levels of competence of graduate teaching assistants in teaching and professional development different based on level of experience?

4. How much support do the graduate teaching assistants perceive they need in teaching and professional development?
   a. Is the support that graduate teaching assistants perceive they need in teaching and professional development different based on level of experience?

The researcher used two quantitative questionnaires to answer questions 1, 3 and 4 and a series of qualitative reflections and interviews and an open-ended set of questions to answer question 2. SPSS software was used to analyze the results of the questionnaires in relation to the experience levels of the GTAs. A multivariate analysis of variance (MANOVA) was conducted to test for significant differences in teaching goals,
perceived competence and support by level of experience (divided into three groups: 0 experience, 1 to 4 semesters experience, and > 4 semesters experience). A MANOVA was chosen since the dependent variables (teaching goals, perceived level of competence and perceived need for support) are all similar in conceptual connotation. A level of significance was set at ≤ .05.

The researcher also employed some qualitative components to further investigate the research questions, specifically questions 1, 3 and 4. All responses were transcribed by the researcher and are presented in this chapter.

Participants of the Study

The study participants were graduate students in the CoST who are or have been on a teaching assistantship. The research includes data collection of the participants’ teaching goals, level of teaching experience, perceived level of competence in teaching and professional development and perceived need for support in teaching and professional development. Demographic data were also collected. Questionnaires were distributed to 101 CoST graduate students and 68 students responded (although only 63 were complete and usable) for a return rate of 67% and a usable rate of 62%. The respondents consisted of 63 graduate students from five disciplines within the CoST at USM. The demographic profile of the GTAs who participated in the study is summarized in Table 3.
Table 3

Demographic Profile of Graduate Teaching Assistant Respondents

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Number of Participants</th>
<th>Gender Distribution</th>
<th>Ethnicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>32</td>
<td>Female: 17</td>
<td>Caucasian: 24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male: 15</td>
<td>Asian: 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Latino: 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other: 2</td>
</tr>
<tr>
<td>Chemistry/Biochemistry</td>
<td>14</td>
<td>Female: 8</td>
<td>Caucasian: 7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male: 6</td>
<td>Asian: 7</td>
</tr>
<tr>
<td>Physics</td>
<td>8</td>
<td>Female: 1</td>
<td>Caucasian: 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male: 7</td>
<td>Asian: 6</td>
</tr>
<tr>
<td>Biology Education</td>
<td>4</td>
<td>Female: 2</td>
<td>Caucasian: 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male: 2</td>
<td></td>
</tr>
<tr>
<td>Chemistry Education</td>
<td>1</td>
<td>Female: 1</td>
<td>Caucasian: 1</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>Female: 1</td>
<td>Caucasian: 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male: 3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>Female: 30 (48%)</td>
<td>Caucasian: 42 (67%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male: 33 (52%)</td>
<td>Asian: 18 (29%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Latino: 1 (1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other: 2 (3%)</td>
</tr>
</tbody>
</table>
Results of Research Question 1: What are the Graduate Teaching Assistants’ Goals?

The Teaching Goals Inventory (TGI), a 52-item questionnaire, was designed to provide a self-assessment of goals for teaching based on what faculty think their students should achieve while enrolled in their courses (Angelo and Cross, 1993). The six emerging themes are arranged in clusters as follows: Cluster I (CI) - higher-order thinking skills, Cluster II (CII) - basic academic success skills, Cluster III (CIII) - discipline-specific knowledge and skills, Cluster IV (CIV) - liberal arts and academic values, Cluster V (CV) - work and career preparation, and Cluster VI (CVI) - personal development. The purpose of the TGI is to provide a self-assessment of teaching goals to help faculty set goals and have something to strive toward as a teacher. The following table includes all of the TGI items, which are listed in the descending order of percentages (within clusters) of graduate students rating the item an essential goal in their teaching. See Appendix J for means, standard deviations and ranges of all TGI items.

Table 4

Percent of GTAs Rating Each TGI Item Essential - Grouped by Cluster

<table>
<thead>
<tr>
<th>Cluster I Higher-order thinking skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of sample rating essential</td>
</tr>
<tr>
<td>53</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>48</td>
</tr>
<tr>
<td>43</td>
</tr>
<tr>
<td>41</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>38</td>
</tr>
<tr>
<td>37</td>
</tr>
</tbody>
</table>
Cluster II Basic academic success skills

<table>
<thead>
<tr>
<th>Percent of sample rating essential</th>
<th>TGI item (abbreviated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Improve writing skills</td>
</tr>
<tr>
<td>29</td>
<td>Develop study skills, strategies, and habits</td>
</tr>
<tr>
<td>27</td>
<td>Improve skill at paying attention</td>
</tr>
<tr>
<td>25</td>
<td>Improve listening skills</td>
</tr>
<tr>
<td>22</td>
<td>Develop ability to concentrate</td>
</tr>
<tr>
<td>21</td>
<td>Improve memory skills</td>
</tr>
<tr>
<td>21</td>
<td>Improve speaking skills</td>
</tr>
<tr>
<td>21</td>
<td>Improve reading skills</td>
</tr>
<tr>
<td>16</td>
<td>Improve math skills</td>
</tr>
</tbody>
</table>

Cluster III Discipline-specific knowledge and skills

<table>
<thead>
<tr>
<th>Percent of sample rating essential</th>
<th>TGI item (abbreviated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>Learn concepts and theories in this subject</td>
</tr>
<tr>
<td>44</td>
<td>Learn terms and facts of this subject</td>
</tr>
<tr>
<td>39</td>
<td>Skill in using materials, tools, technology</td>
</tr>
<tr>
<td>29</td>
<td>Techniques/ methods to gain knowledge in subject</td>
</tr>
<tr>
<td>27</td>
<td>Evaluate methods and materials in this subject</td>
</tr>
<tr>
<td>23</td>
<td>Understand perspectives and values of subject</td>
</tr>
<tr>
<td>16</td>
<td>Appreciate important contributions to this subject</td>
</tr>
<tr>
<td>13</td>
<td>Prepare for transfer or graduate study</td>
</tr>
</tbody>
</table>

Cluster IV Liberal arts and academic values

<table>
<thead>
<tr>
<th>Percent of sample rating essential</th>
<th>TGI item (abbreviated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>Develop openness to new ideas</td>
</tr>
<tr>
<td>19</td>
<td>Develop lifelong love of learning</td>
</tr>
<tr>
<td>18</td>
<td>Capacity to make informed ethical choices</td>
</tr>
<tr>
<td>18</td>
<td>Informed understanding of role of science and tech</td>
</tr>
<tr>
<td>15</td>
<td>Concern about contemporary social issues</td>
</tr>
<tr>
<td>13</td>
<td>Commitment to exercise rights and responsibilities</td>
</tr>
<tr>
<td>10</td>
<td>Develop an informed historical perspective</td>
</tr>
<tr>
<td>10</td>
<td>Informed appreciation of other cultures</td>
</tr>
<tr>
<td>8</td>
<td>Develop aesthetic appreciations</td>
</tr>
</tbody>
</table>
Cluster V Work and career preparation

<table>
<thead>
<tr>
<th>Percent of sample rating essential</th>
<th>TGI item (abbreviated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>Improve follow directions, instructions, and plans</td>
</tr>
<tr>
<td>39</td>
<td>Develop commitment to accurate work</td>
</tr>
<tr>
<td>31</td>
<td>Improve ability to organize / use time effectively</td>
</tr>
<tr>
<td>31</td>
<td>Develop ability to perform skillfully</td>
</tr>
<tr>
<td>27</td>
<td>Develop ability to work productively with others</td>
</tr>
<tr>
<td>25</td>
<td>Develop commitment to personal achievement</td>
</tr>
<tr>
<td>19</td>
<td>Develop management skills</td>
</tr>
<tr>
<td>18</td>
<td>Develop leadership skills</td>
</tr>
</tbody>
</table>

Cluster VI Personal development

<table>
<thead>
<tr>
<th>Percent of sample rating essential</th>
<th>TGI item (abbreviated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>Cultivate an active commitment to honesty</td>
</tr>
<tr>
<td>42</td>
<td>Develop capacity to think for one’s self</td>
</tr>
<tr>
<td>32</td>
<td>Develop capacity to make wise decisions</td>
</tr>
<tr>
<td>31</td>
<td>Cultivate sense of responsibility for behavior</td>
</tr>
<tr>
<td>31</td>
<td>Improve self-esteem/self-confidence</td>
</tr>
<tr>
<td>23</td>
<td>Develop respect for others</td>
</tr>
<tr>
<td>18</td>
<td>Cultivate emotional health and well-being</td>
</tr>
<tr>
<td>16</td>
<td>Develop commitment to one’s own values</td>
</tr>
</tbody>
</table>

The following table includes the overall cluster means, standard deviations and percent of sample rating the item as essential. See Appendix J for means, standard deviations and ranges of each individual TGI item.
Table 5

*Summary of TGI Responses by Cluster*

<table>
<thead>
<tr>
<th></th>
<th>CI</th>
<th>CII</th>
<th>CIII</th>
<th>CIV</th>
<th>CV</th>
<th>CVI</th>
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<tbody>
<tr>
<td>Mean</td>
<td>4.16</td>
<td>3.55</td>
<td>3.82</td>
<td>3.08</td>
<td>3.69</td>
<td>3.60</td>
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<tr>
<td>SD</td>
<td>0.92</td>
<td>1.16</td>
<td>0.99</td>
<td>1.21</td>
<td>1.11</td>
<td>1.20</td>
</tr>
<tr>
<td>% rating essential</td>
<td>43.8</td>
<td>24.6</td>
<td>29.9</td>
<td>14.0</td>
<td>28.9</td>
<td>29.4</td>
</tr>
</tbody>
</table>

Results of Research Question 2: What Pedagogical Education and Supervision do the Graduate Teaching Assistants Receive?

To find out how much pedagogical education and supervision respondents received, an open-ended questionnaire was disseminated. Respondents were asked if they had any training to teach and if so, what type of training. The options for responses included 1) no training, 2) department training/workshop, 3) college training/workshop, 4) campus-wide training/workshop and 5) formal coursework. Of the valid responses (N=63), 58.7% have had training while 41.3% have not had training. Of the almost 60% who have received some sort of training through a workshop or formal coursework (Figure 1) the largest percentage, 49.2% attended a workshop or training session hosted by their department, 25.3% had some sort of formal coursework, while 19% had attended a college training or workshop and only 8% had attended a campus-wide training workshop. Since the respondents were asked to choose as many options that applied (i.e.,
the types of training or formal coursework they had received), the percentages add to more than 100%.

Many of the respondents reported receiving more than one type of training. Figure 2 depicts the number of pedagogical education sessions attended by GTAs. Of the almost 60% who reported having some pedagogical education, 33.3% have had only one type of training or formal coursework, while 11% had two types of training or formal coursework and 11% had three types of training or formal coursework. Only 3.2% of the respondents had all four types of training and formal coursework.

*Figure 1.* Type of pedagogical education reported by GTAs.
Forty-one point three percent of the GTAs responding to the questionnaire have taken at least an hour of teacher education coursework as a part of their formal degree coursework. Figure 3 depicts the percentage of GTAs who have taken no formal courses (58.7%), 1 – 3 credit hours (27%), 4 – 6 credit hours (1.6%) or more than 6 credit hours (12.7%) of teacher education coursework.

*Figure 2. Number of education sessions attended by respondents.*
Figure 3. Percentage of GTAs earning teacher education credit hours.

Supervision

Most GTAs receive some sort of supervision from a member in their department. Of the participants in this study, 74.6% are supervised when they teach. Most (61.9%) have a weekly group meeting with their supervisor. Figure 4 depicts the type and frequency of supervision provided by faculty in the CoST at USM.
Results of Perceived Level of Competence and Need for Support

The perceived level of competence and need for support in teacher preparation and professional development questionnaire was used as a measure of one’s belief in ability and measures the important variable of teacher effectiveness and consequent student achievement. It focuses on how competent the GTAs think they are and how much support they think they need for teaching and for professional development. All of the mean scores for each teacher preparation and professional development item for competence and support are listed in Appendix I.
**Competence.** Of the teacher preparation and professional development items, GTAs perceive that they are most competent in the following items:

- Using Excel for grading (M = 4.41, SD = 0.88)
- Using PowerPoint effectively (M = 4.16, SD = 0.99)
- Operating a projector (M = 4.07, SD = 1.09)
- Constructing quiz questions (M = 4.03, SD = 0.95)
- Beginning and ending each class (M = 4.02, SD = 0.90)

and least competent in the following:

- Serving on State Committees (M = 2.00, SD = 1.19)
- Serving on national committees (M = 2.00, SD = 1.18)
- Grant writing (M = 2.27, SD = 1.30)
- Developing a service learning project (M = 2.34, SD = 1.17)
- Serving on departmental committees (M = 2.38, SD = 1.16).

**Support.** Of the teacher preparation and professional development items, GTAs perceive they need the most support in the following items:

- Grant writing (M = 4.10, SD = 1.09)
- Submitting a manuscript for publication (M = 3.74, SD = 1.30)
- Serving on state committees (M = 3.70, SD = 1.32)
- Developing a manuscript (M = 3.67, SD = 1.30)
- Serving on national committees (M = 3.64, SD = 1.27)

And need the least support in the following:

- Using Excel for grading (M = 1.88, SD = 1.24)
• Operating a projector (M = 2.02, SD = 1.20)
• Beginning and ending each class (M = 2.03, SD = 1.17)
• Using PowerPoint effectively (M = 2.10, SD = 1.28)
• Constructing quiz questions (M = 2.22, SD = 1.14)

Overall, respondents perceive that they need less support on the teacher preparation items than on the professional development items.

Future Teaching Plans

Respondents were asked to report if they plan to teach when they graduate. 68.3% responded yes, while 25.4% said no and 3.2% were undecided. Of those who reported that they had plans to teach, 42.9% plan to teach at the university level, 7.9% plan to teach at a community college or university, 7.9% plan to teach at a community college, and 3.2% plan to teach at a community college or K-12.

MANOVA

A one-way MANOVA was conducted to determine the effect of experience level (divided into three groups: 0 experience, 1 to 4 semesters experience, and > 4 semesters experience) on the respondent’s teaching goals, perceived level of competence and need for support with teacher preparation and professional development. MANOVA results revealed no significant differences among the levels of experience on the dependent variables, Wilks’ Λ=.868, F(6,112)=1.37, p=.233, multivariate η²=.068. Analysis of variance (ANOVA) was conducted on each dependent variable as a follow-up test to MANOVA. Level of experience was significant for need for support, F(2,58)=3.46, p=.038, partial η²=.107. Differences in teaching goals were not significant,
\( F(2,58) = .855, \ p = .430, \ \text{partial } \eta^2 = .029. \) Differences in perceived level of competence were not significant, \( F(2,58) = .949, \ p = .393, \ \text{partial } \eta^2 = .032. \) The Bonferroni post hoc analysis revealed that perceived need for support in those with no teaching experience is significantly higher from those with one to four semesters teaching experience. Table 6 presents means and standard deviations for teaching goals, perceived level of competence and need for support by experience level.
Table 6
Means and Standard Deviations for Teaching Goals, Perceived Level of Competence and Need for Support

<table>
<thead>
<tr>
<th>Experience Level</th>
<th>Goals M</th>
<th>Goals SD</th>
<th>Competency M</th>
<th>Competency SD</th>
<th>Support M</th>
<th>Support SD</th>
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<tbody>
<tr>
<td>0</td>
<td>3.74</td>
<td>.809</td>
<td>3.14</td>
<td>.712</td>
<td>3.31</td>
<td>.828</td>
</tr>
<tr>
<td>1 to 4 semesters</td>
<td>3.49</td>
<td>.667</td>
<td>3.29</td>
<td>.634</td>
<td>2.69</td>
<td>.691</td>
</tr>
<tr>
<td>&gt;4 semesters</td>
<td>3.71</td>
<td>.700</td>
<td>3.47</td>
<td>.622</td>
<td>2.70</td>
<td>.855</td>
</tr>
</tbody>
</table>
Results of Reflection and Interview Questions

For the qualitative component, a small, nonrandom sample was chosen from the GTAs who volunteered to participate in this component of the research study. The researcher chose the six volunteer participants who represented one of each of the three levels of teaching experience (i.e., 0 experience, 1 to 4 semesters experience, > 4 semesters experience) so she could delve deeper into the participants’ teaching goals, perceived competence, and support needed in order to try to answer the research questions. One of the participants had no teaching experience, two had taught one to four semesters and three had taught more than four semesters, keeping the levels of teaching experience consistent with the quantitative data collection. During the fall 2009 semester, the participants each reflected upon their teaching and replied to a series of questions that were administered at three different times: 1) the night before they taught their first lab, 2) after they taught their first lab and 3) again at the mid-point of the semester. Interviews were conducted with each individual participant and consisted of the researcher reviewing the responses from each cluster of reflection questions for the participant and then posing questions such as, what are you thinking now? When necessary, the researcher also encouraged respondents to elaborate on a comment that needed more explanation. The findings have been organized and are consistent with three of the four research questions:

1. What are the graduate teaching assistants’ goals for teaching?

3. What is the perceived level of competence of graduate teaching assistants in teaching and professional development?
4. How much support do the graduate teaching assistants perceive they need in teaching and professional development?

Since the qualitative aspect of this research is longitudinal in nature, the data are presented by respondent for each research question starting with the most experienced GTA and finishing with the least experienced. Their responses are detailed below.

Research Question 1: What are the Graduate Teaching Assistants’ Goals for Teaching?

The night before the graduate teaching assistant (GTA) participants taught their lab for the first time, they were asked to reflect and write about several aspects of their teaching. The first reflection question was, “What are your teaching goals for the semester?” The night after teaching the first lab, GTAs were asked a second reflection question about their teaching, “Do you think you will be able to accomplish your teaching goals for the semester? Explain.” At the midpoint in the semester, GTAs were again asked to reflect on their teaching by responding to the question, “What are your teaching goals for the semester? Have they changed since the beginning of the semester?” Interviews were conducted during the last week of the semester. Participants were reminded of their reflective responses throughout the semester and then asked to reflect on their thoughts now that the semester was coming to an end. In some cases, GTAs were asked to elaborate on particular comments that warranted more explanation. The responses from each GTA are now presented.

Maggie. With 12 semesters of laboratory teaching experience, the most experienced GTA, Maggie, presented her goals for teaching the general botany laboratory as
1) teach students about plant-related topics, 2) discuss real-life situations in the past and present that deal with plants, 3) help students find easy ways to remember information and Latin that will help with other classes, 4) give students a better understanding of algae, fungi, and plants, 5) help them make connections and see the bigger picture, and 6) help them have a greater appreciation for plants and realize that science and plants can be fun!

The night after teaching the first lab, Maggie reflected on the question, “Do you think you will be able to accomplish your teaching goals for the semester? Explain.” She responded,

I do think I will be able to accomplish my teaching goals for the semester. My experience in teaching other labs and taking classes has helped me come up with and share “easy” ways to remember ideas, plant names, Latin, etc. I have a strong plant background so I am confident I will be able to pass information about plants, fungi, and algae. I have learned to be very enthusiastic when teaching “boring” subjects in the student’s eyes by researching fun facts and events dealing with my topic for the day.

At the midpoint of the semester, Maggie was asked again to reflect on her teaching goals and answer the questions, “What are your teaching goals for the semester? Have they changed since the beginning of the semester?” Maggie responded,

I do not think my goals have changed since the beginning of the semester. I try to bring up current issues dealing with plants whenever I can. I also continue to engage students with interesting facts about plants and help them learn easy ways
to remember scientific names or facts.

During the interview, Maggie was reminded of her reflective responses throughout the semester and then asked to reflect on her thoughts now that the semester was coming to an end. I asked Maggie to reflect on her teaching goals now that the semester was over. I then asked her if she thought she had achieved her goal(s). She responded by reflecting upon how she attempted to accomplish her goals this semester. She replied,

50/50 at this point; helping them with the names – Latin I did well; the goofy things has helped them learn; they have to learn 50 native species name of plants. We traveled to Wiggins to see pitcher plant “we went to Wiggins and saw a lotta…” Sarracenia alata; it helps things stick; big picture things maybe didn’t get; we started with fungi, algae then plants and taught about primitive to more advanced and some did not get it; they could not make the connection; seeing the overall places they are, the phylogeny, taxonomy is too hard for them to get; that is very frustrating since even at the end of the semester they couldn’t grasp domain. Current events and fun facts were thrown in all semester and I think that helped to teach them and interesting facts helped bring it back to memory. I think that a few labs were very boring but I would make silly jokes or show a cartoon and they would giggle and laugh. They are always waiting to see what I will do next; humor helps to achieve these goals; you don’t have to be funny, I am silly most of the time; so it is not boring ho-hum; they are like 5 year olds, their attention span is short.
Sam. With 10 semesters of laboratory teaching experience, the second most experienced GTA, Sam, presented her goals for teaching the comparative anatomy laboratory as

Considering this is my first opportunity to repeatedly instruct the same course at USM, my goals no longer consist of merely ‘surviving the semester’ or ‘staying ahead of the students’. Prior experience with this course ensures that those objectives will be met, allowing me to develop personal goals regarding my teaching methodology. This semester, I will work towards two major ambitions: 1) To be a more efficient and knowledgeable instructor than the first time I assisted with this course. Due to the manner in which it is taught, my first experience with the Comparative Anatomy lab was truly stressful. Being a task-oriented course, the ‘flow’ of the class period was that of which I was unaccustomed. There are no lectures in this lab and interactions with students are on a much more one-on-one basis. Of the 7 dissections assigned, I had only previously experienced two. Considering it is difficult to prepare for a dissection without actually performing the task, I felt immensely unprepared. There were also numerous techniques of which I was unfamiliar or inexperienced. To help prepare me somewhat, I would look at online dissections and notes posted by instructors from other universities. If additional specimens were available, I would often perform dissections outside of class. After watching me work diligently to prepare for each day’s topic, the Instructor-of-Record shared that what I was experiencing was nothing unique and that he himself had a steep-
learning curve the first time he taught this course. Eventually, I resigned myself to accept that experience is the most effective means of preparation for this course and after continuous hard work, I survived the semester. Armed with a semester’s worth of experience (and a ton of supplementary notes), I now hope to apply what I learned last fall to my class this semester. 2) To be pleased with my performance and enjoy what I am doing. I consider my previous performance in this course as ‘acceptable’, which is personally unsatisfactory. Hopefully, prior experience with the course and its techniques will allow me to feel better prepared so that I can perform at my own standards. Once I am performing at what I consider a satisfactory standard, I enjoy teaching more and that benefits everyone.

After Sam taught her first lab, I asked her to reflect upon her ability to accomplish her teaching goals for the semester. She wrote,

Considering the nature of this course, attainment of my goals this semester will depend a great deal on knowledge acquired through prior experience. I was moderately pleased with my performance during the first lab of this semester, which encourages me to believe that my goals are achievable. As opposed to the last time I assisted with this lab, I was able to answer questions from students with greater ease this time around. Having never taken intensive courses concerning certain taxonomic groups (e.g. Herpetology); I fear being asked questions beyond the basic characteristics of these specific classes. Prior experience with this course and recent experience with others (General Biology II) helped with this, as
well as information acquired through assisting colleagues in their respective
research. I hope that the future labs benefit from my past experience. If not, it
may be another stressful semester.

At the midpoint in the semester, she was asked to restate her teaching goals for
the semester. She was also asked if her goals had changed since the beginning of the
semester. She replied,

My teaching goals for this semester are to be a more efficient instructor and to be
pleased with my teaching performance. These goals have not changed since the
beginning of the semester. I want to be a more competent assistant in the
Comparative Anatomy lab and the feedback I am getting from students suggests
that I am achieving this goal. My reliance upon the major professor is now
minimal and I perform necessary techniques with greater skill. This has resulted
in a less stressful experience than my first encounter with the course and I am
beginning to enjoy teaching it more. Although I am still not 100% pleased with
my performance, I feel as though I am approaching a personal score of
‘satisfactory’.

When Sam was interviewed, she was reminded of her reflective responses
throughout the semester and then was asked to reflect on her thoughts now that the
semester was coming to an end. She replied,

Well I was certainly better at teaching than the first time but still not 100%
confident in the course because I still get stumped; even the major professor gets
stumped. I enjoyed it more. There is no lab manual, there are only handouts
which are not necessarily going to look like what the specimens look like; we have lots of specimens to dissect (seven). One thing we noticed is that last year’s class was very competent; this year’s students wanted the (G)TA to do it for them because they were terrified of butchering their specimen. We ((G)TA and Professor) worked harder with this group than the last group; we felt like we were pulling them through. We were not entirely pleased with the result but I do feel it was better than last time and I have a long way to go.

Sam mentioned that she wants to teach this lecture when she finishes her degree. She also added that she thought this semester was definitely an improvement from last fall.

When Sam was asked if she thought she had achieved her goals, she responded, You (should) never give yourself enough credit – I think when you do is when you start getting sloppy and over confident. Since you don’t know every answer, that is one reason why I’m not completely pleased. It keeps me from being lazy, it is a humbling experience because I hate to not know an answer when I feel as though I should know it. Nobody can remember all of this. For example today they were responsible for knowing 50+ muscles in addition to skeletal structure and organs. I have learned tricks to help not look clueless. We spent a month on the cat – lots of different muscle complexes that are difficult to tease apart. One (lab) group will ask about one complex while another group will ask about another, so we would use handouts to say ‘look here is this’ and in actuality we were refreshing our memory of muscles so you don’t look so clueless. I certainly
became more efficient and knowledgeable and can perform all techniques with as much skill as the professor could, but I’m not 100% pleased and I don’t know if I ever will be.

Melanie. The GTA with eight semesters of teaching experience, Melanie, reflected on her goals for teaching first-semester general biology laboratory the night before teaching for the first time. She wrote that her goals were,

making sure that I come across clear which in turn the students will be able understand all 13 topics. I want my students to be able to communicate scientifically (using the correct vocabulary). I also want to make sure that my students get that science is fun and everyday functions relate back to science.

After she taught her first lab, she was asked if she thought she could accomplish these goals. She replied,

Yes, I do. I am really excited about teaching this semester. I find my ideas about teaching are changing into a solid and positive manner. I find I am trying to show the important things I didn’t necessarily think were important only until later did I realize I was wrong (not just knowing the vocabulary but actually using the words in conversations).

At the midpoint in the semester, she was asked to reflect once again on her teaching goals for the semester and if they had changed since the beginning of the semester. She replied,

I want my students to be able to communicate scientifically (using the correct vocabulary). I also want to make sure that my students get that science is fun and
everyday functions relate back to science. I do not think my goals for this semester have changed. By asking questions to the class throughout the lab (lecture and when performing the experiment), they are improving their vocabularies. For this semester, I added a 5 minute section before lab where we discuss a current topic in biology (preferably on the topic we are discussing in lab). I have had a lot of students find the topics interesting and ask where I found the information. I can see many are interested in science by the questions they ask. I enjoy doing the 5 minute discussion to get them thinking about science and showing how science is fun.

When Melanie was interviewed, she was reminded of her reflective responses throughout the semester and then was asked to reflect on her thoughts now that the semester was coming to an end. She replied,

I think they were positive; I think what I didn’t realize as an undergrad is that vocabulary is very important; if can’t comprehend terms can’t understand reading material; should learn how to say them and spell them correctly; try to correct them and make them repeat it back to me so that they know they are saying it correctly; especially after topic 1 understanding dependent and independent variables I knew how important that was after teaching the lab several times; that was stressed as well: having a basic understanding; keeping it fun is definitely something I will be consistent with; I want them to be happy in a classroom; based on previous research if you have laughter people will do better; goal of 5 minute introduction – that actually turned out really well; people liked it. I
typically had a five minute introduction where I would go through discovery news or science or some website. I would get when talking about animal behavior – how animals can change depending on where they are – I brought up articles about birds and the song differing from suburb to city; they got really excited and it got them interested in it – one student asked where do you find this information? He asked, ‘why isn’t this important news?’

Melanie was also asked if she thought she had achieved her goals? She replied, Yes, you can tell by the end of the semester. When I wasn’t there you could tell when you come back they realize that this is the way I am used to it, they enjoyed the class; only had 2 or 3 miss all semester; I think that this supports that I achieved my goals that they wanted to come to class and it was fun.

Jim. The GTA with the fourth most teaching experience (four semesters) is Jim. Before he taught his first lab, he was asked to reflect on his goals for teaching the second-semester general chemistry laboratory for the semester. He replied,

I would like to make sure that my students understand the purposes of the experiments they perform. Science is much more interesting when there is a purpose behind the procedures. I don’t expect to be perfect in my lectures, but I would at the very least not like to confuse the students. I would like to make sure all of the students are safe throughout the semester. On a personal note, I would like to improve my own teaching and public speaking skills.

After teaching the first day, he was asked if he thought he could accomplish his goals this semester. He said,
I believe so. Once the lab begins a lot of my nervousness went away and I feel I did a fairly decent job of relating to my students. One of my biggest concerns was my ability to explain the material effectively to the students, and I believe I did that.

At the midpoint of the semester, he was asked to restate his teaching goals and was asked if any of them had changed. He wrote,

My teaching goals have not changed much. I still want to help the students better understand the material covered in each lab so they understand better in class. Now that formal lab reports are due, I want to help them learn to write more scientifically. Until this point they have merely copied data, but the further they advance in any science, the more writing is required.

During an interview at the end of the semester Jim was reminded of his responses given throughout the semester. He was then asked what he was thinking now and if he thought he had achieved his goals. He said,

The ones that enjoyed lab got the aspect of what I was going for…understanding what we were doing…even while doing lab they would ask ‘why are we doing this?’ That was little frustrating, but I think I did a good job explaining the material. I know I go too fast, and my handwriting is not great. They would get confused between my 4’s and my 8’s, so, maybe presentation is something I can work on for next semester. Actual talking I do okay but writing is not good. It seemed like a good goal but time restrictions… you have advanced study
assignments, quizzes and the lab/data that they complete for every student every week and I have a total of 50-something students.

*Tina.* The GTA with the fifth most teaching experience (one semester), Tina, reflected on her goals for teaching the first-semester general chemistry laboratory the night before teaching. She developed goals for her students and goals for herself. She wrote that the goals for her students were,

- Obtain or improve ‘lab hands’, be able to work in a lab safely and attentively,
- improve mathematical abilities (specifically, manipulation of formulas), increase the confidence of students (confidence in academic ability, scientific ideas and laboratory technique), improve writing skills (especially technical writing) and improve ability to follow directions.

Tina’s goals for herself included “provide clearer directions in pre-lab instructional time, improve class management (become more confrontational) and increase confidence in teaching and conducting class.” During the interview at the end of the semester, Tina was asked to elaborate on her statement “improve class management (become more confrontational)”. She said,

Because when I started teaching and since I am so close in age to the students – when there is a problem, I tend to adapt. As the teacher, you need to confront them, maybe not aggressively, but since it is my job and not in my character to do this, it has to be done. As a teacher, I had a student who was cheating on a quiz, I don’t really know the best way to approach that; is it to stand there and hope they will stop or is it to confront them and say hey I saw that you cheated on this quiz
and you will not get credit for it. I guess just to be more confident since it is my role as the teacher as the person in charge.

After Tina taught her first lab, I asked her to reflect upon her ability to accomplish her teaching goals for the semester. She wrote,

Yes, I believe (I can accomplish my goals), for the most part. My experience last year helped me to identify the places students get confused in the laboratory experiments and to alter my pre-lab lectures accordingly. With my knowledge from last year, I believe I will be able to give my pre-lab directions more clearly. I definitely believe I will increase my confidence as a teacher and my classroom management skills. This year, the two first days for my two sections went drastically different from last years. My confidence in not only the content, but also my role as the teacher, has increased. I believe that will continue through this coming semester.

At the midpoint in the semester, she was asked to restate her teaching goals for the semester. She replied,

Many of the goals for myself are the same. I still would like to increase my confidence as a teacher and improve my classroom management skills (e.g. be more confrontational when problems arise). I also would like to continue to give clear pre-lab instructions. However, in addition to these goals, I believe this semester I’ve become very aware of equality. While I have always been aware that students should perceive me as a fair and just person, I feel this semester has made me increasingly aware of the small acts that can have an effect on their
opinion. I always make an effort to treat students equally, regardless of their previous performance or my initial perception; however, in order to be perceived by students as fair, it sometimes takes more than this. It’s almost as if you have to exaggerate your impartiality.

When Tina was interviewed she was asked to elaborate on these statements. She replied,

Confidence…me actively thinking about it. I have to keep reminding myself that if I let it slide once, it is going to happen again. I try to think about teachers who have not been fair, maybe because of confidence. As a student who wasn’t aggressive, the teacher knew I wasn’t going to go back and ask about a question I might have gotten wrong. As the teacher, I think that is unjust/unfair to treat students differently. If I tell one guy with good grades who got it wrong and another with not good grades and they come up to me and say, but, what about this part, I need to treat them fairly. I want to be a good teacher not a passive teacher. The confidence to say I’m the teacher and you are doing this wrong. And also to be able to say you are doing this right. Regarding classroom management… the ability to separate myself; I’m 24 and I look the same age as some of them. Some students treat me like a peer and then some treat me like I’m 40, they call me Miss Tina. I would say similarly, need confidence. Labs can be hard to manage, I am looking forward to teaching lecture, because in lab, you have students all doing different things. Sometimes I have them working in pairs; it can be crazy managing the flow of the room. I usually have six students that get
done really quick and then a few that will be there until the end and then the large mass that will get done somewhere in between. You will have some that are bored, some lost and some in between. A big thing for me is I want to have a good reputation as a teacher. Being in the classroom a week, I realized the type of teacher that I am and want to be. A lot of students don’t like me because I am hard and a lot of students like me because I am hard and I can tell that. I want to be a teacher like that. A teacher that will make you learn but is fair and isn’t going to go to the way side because they are confident.

At the midpoint in the semester, she was also asked if her goals had changed since the beginning of the semester. She stated,

A new goal I have is to try and remove any acts that could be conceived as partiality, whether or not they come from an actual bias. At the same time, I would prefer for students to feel that I am nice and that I do like them, just not any more or less than another student. I’m finding it hard to strike a balance; I’m hoping to come closer to this middle ground this semester.

When Tina was interviewed, she was reminded of her reflective responses throughout the semester and then was asked to reflect on her thoughts now that the semester was coming to an end. She replied that she will, “restructure her pre-lab next semester.” She also said that she thought she had “gained experience in teaching” and through that she has increased her confidence a lot. People think I am introverted and shy, but I don’t think of myself this way. For example, I gave directions to an auditorium of
chemistry students about to take a final exam. I thought about it later and realized I had changed a lot. My confidence that I can do the job I am doing. It helps that it is my second semester since the material is the same this time around.

*Mandy.* The GTA with no teaching experience is Mandy. When she was asked to reflect on her goals the night before teaching the first-semester general chemistry laboratory for the first time, she wrote that she had a few goals for the semester.

First, I hope to aid the students in understanding the material they have heard in the lecture class. I hope to set a good example and help the students become more interested in the material and want to learn about chemistry. I hope to make the laboratory as fun and interesting as possible. I also hope to show them that what they learn in the classroom and in the laboratory is applicable in real life.

When asked to reflect upon her ability to accomplish her teaching goals for the semester after she had taught her first lab, she replied,

I think I will be able to accomplish most of my teaching goals for the semester. During this first week of lab, I was able to see what each one of my classes was like. I think this will help because I will be able to make the material more personalized for each class, and help them get a better grasp on the information.

At midterm she was once again asked about her goals and if they had changed since the beginning of the semester. She said,

I still hope that the students are learning as much material as they can in my course, and that I am aiding them in doing so. A more recent goal of mine is to learn from the students, in addition to helping them learn. I realized that they all
come from different backgrounds, and all have different methods of learning the material. In order for each of them to learn, I must figure out different ways to communicate the course material so that they can all grasp the concepts.

When Mandy was interviewed she was reminded of her reflective responses throughout the semester and was then asked to reflect upon her new goal that was set. She replied,

I realized that I didn’t really want to go into research as much for my career and that I want to go into teaching so if I can learn from them then I’ll be able to apply it in other semesters. I hadn’t thought that teaching would be something I wanted to do. After only six labs I have liked it. I feel like the students have learned and become more comfortable in the lab. It is self satisfying to know that you are helping somebody else.

She was reminded that she also said she realized that they all come from different backgrounds, and all have different methods of learning the material. She indicated that she had learned “in order for each of them to learn, you must figure out different ways to communicate the course material so that they can all grasp the concepts.” She added,

Some took college chemistry in high school and some didn’t have it at all. Some are visual learners, some hands-on. With pre-lab lectures, use visuals, write on board, show example, if have questions, were encouraged to ask. I tried to relate information to course work with examples and this probably helped with coursework.
I then asked her, “Why did you change your goals?” She replied, “Teaching might be something that I want to do as a result instead of research based work. I feel the students have learned and become more comfortable in the lab.” I followed that question up by asking if she thinks she had achieved her goals. She said,

Yes, I do. I wanted to help them learn, and as I was going through the final grades, most students had an A or B, so, by looking at those grades and the effort they put in, it seems as if they had learned something. I was also able to learn from them. The first lab I went in and just wrote on the board and I realized that some of them would not be able to learn that way so I learned that I needed to show them or explain with words.

*Research Question 3: What is the Perceived Level of Competence of Graduate Teaching Assistants in Teaching and Professional Development?*

The night before the graduate teaching assistant (GTA) participants taught their lab for the first time, they were asked to reflect and write about their confidence in teaching. The reflection question was, “How confident are you in the content that you will teach tomorrow?” The night after teaching the first lab, GTAs were asked a second reflection question about their teaching, “Do you think you have the knowledge and skills necessary to effectively teach your course? Explain.” At the midpoint in the semester, GTAs were again asked to reflect on their competency level by responding to the question, “How confident are you in the content that you have taught this semester and will teach the rest of the semester?” Interviews were conducted during the last week of the semester. Participants were reminded of their reflective responses throughout the
semester and then asked to reflect on their thoughts now that the semester was coming to an end. In some cases, GTAs were asked to elaborate on particular comments that warranted more explanation. The responses from each GTA are now presented.

Maggie. Maggie replied, “I am extremely confident in the content I will be teaching.” Then, the night after teaching the first lab, I asked her if she had the knowledge and skills necessary to effectively teach her course. She wrote,

I do think I have the competence necessary to effectively teach this course because I have taught it four times prior and I have learned more on the subject through not only my research but from reading various books and journals. I continually go over my powerpoints and notes and update them as new information like molecular data, new species, name changes, etc. come in.

At the midterm of the semester, I asked her to reflect on the question, “How confident are you in the content that you have taught this semester and will teach the rest of the semester?” She said,

I am confident when it comes to content that I have already covered and the material I will cover the next two weeks. I’m not so confident about the rest of the semester because we haven’t discussed what to talk about or what experiments to perform.

Interviews were conducted during the last full week of the semester. I reminded Maggie of the responses she had given regarding her confidence in her teaching. I then asked her, “What are you thinking now?” She replied,
Unfortunately it was the same as always. We have a hormone lab and with a
lecture and experiment where we mention the hormones that plants have, it takes
45 minutes for them to do it and then it is like, okay, what do I do now?... again,
the last three were unprepared. There were experiments that could be done but it
would take too long and with everybody’s schedule we just couldn’t get
together… it did not happen very well. We were supposed to do a field trip but it
rained Monday – Wednesday so couldn’t do the field trip. The other (G)TA could
not drive so I did a review even though I had reviewed with the hormone lab. He
reviewed and it was very frustrating and unstructured. What we cover is the same
thing, it is short but could be better, it could be a lot better. If I had more time I
would have taken the time to get the stuff for the experiments. If I was in control
of the lab, since we talk about plants, how do leaves change color, why,
photosynthesis, what layer, lots of experiments we could have done like with
bananas and ethylene gas… talk about the hormones… don’t want to go too in-
depth – so that it isn’t too complicated. By doing experiments it would help. I
would have done more hands-on labs the entire lab, but we didn’t; the way it is set
up now it is like a 2nd lecture. They need more than a lecture because the material
is difficult so when they see it again because they understand it more…then
should have done more hands-on instead of me talking from 2 – 4:45, which we
do the first few labs which is basically their second lecture on the material. If
could do more experiments I wouldn’t have to talk as long because they would
understand it because they are doing it.
Sam. The night before Sam taught her first lab I asked her how confident she was in the content that she would teach the next day. She replied,

Considering the first lab of this course is an introduction to vertebrate classes, I feel fairly well prepared. Most of this confidence stems from previous experience with other courses that I have taught (General Biology II, Zoology). Having taught these topics numerous times, I feel comfortable with the material and will often elaborate on groups of which I have amassed personal research experience (birds, mammals). In addition, I often use this as an opportunity to shamelessly plug my own research in hopes of encouraging undergraduate participation within graduate research.

Then, the night after teaching the first lab, I asked her if she had the knowledge and skills necessary to effectively teach her course. She wrote,

This is a difficult question to answer because my opinion of my own personal competency is fairly detrimental. Based on my prior experience with vertebrates, I consider myself technically competent to teach this course, but as of this moment, I am not yet pleased with my teaching performance in this lab. Do I have experience working with multiple vertebrate groups? Yes. Do I have a fair degree of skill when it comes to dissections? Yes. Do I feel confident that at this given moment I can identify every muscle, organ, bone, etc. within every specimen that this class investigates? No, but I am learning. I feel as though I am a work in progress.
At the midterm of the semester, I asked her to reflect on the question, “How confident are you in the content that you have taught this semester and will teach the rest of the semester?” She said,

My confidence level varies with the specimens we study throughout the semester. While I feel fairly confident dissecting sharks and frogs, I am still slightly uncomfortable teasing apart muscles of pigeons and cats. The rest of this semester is an in-depth dissection of the muscles, skeleton, and organs of the cat. I believe this dissection will certainly go better for me this year than last, but how much better is unknown.

Interviews were conducted during the last full week of the semester. I reminded Sam of the responses she had given regarding her confidence in her teaching. I then asked her, “What are you thinking now?” She replied,

Comparing self to others who have taught this, I have given myself a break. I compare myself to others I have seen even though I am a doctoral student I am still fairly impressionable and there are various people that I respect so I want to try to achieve a higher standard. For example – the instructor of record is a brilliant vertebrate biologist I respect him so much. The dialogue he can carry on is amazing. I would like to be able to have that skill at some point. I have learned more from professors who could do that. Students can sense weakness, if students sense weakness then they don’t respect you as much. I would like to be that confident and that competent. I don’t want to just get by I want to be able to give additional information. If a professor gives the answer and then tacks on
something else like a real world example, I remember it better – just a little
something to help me remember, I admire that. I can do it with some things right
now, but with others I am just getting by.

**Melanie.** The night before Melanie taught her first-semester general biology lab
for the first time, she was asked to reflect and write about her confidence in teaching.
The reflection question was, “How confident are you in the content that you will teach
tomorrow?” Melanie replied,

> I always get nervous when I talk about the difference between independent and
dependent variables. The same goes for controlled variables and control groups. I
find that students have a hard time getting the two topics.

During the interview at the end of the semester, I asked Melanie if she overcame
that. She said,

> This semester I went over it several times as a whole class, some people would
really get it and some people wouldn’t. I went around to tables and explained
independent and dependent variables. If they had a particular question I would sit
with them and give examples…I felt like that worked a lot better than usual.
When have to do fish experiment and topic 10 have to know so can write the lab
report. It helps them write a hypothesis if they know the difference. Check their
answers and make sure and ask why they would do this. Does this depend on this
or does this depend on that? Control and control group went better too!

Then, the night after teaching the first lab, I asked her if she had the knowledge
and skills necessary to effectively teach her course. She wrote,
Yes, I do. The courses I have taken over the years, as well as reading scientific papers/watching documentaries on biology, I feel competent in teaching/talking about the information in the lab manual. Also, through the years of teaching, I find that my confidence in front of the classroom has increased. I enjoy briefly expanding the topics when students are inquisitive. I also find that noticing their behaviors (actually looking at the students without hesitation/pay attention to their moods and reading their body language) has allowed me to ask them why? And try to understand/try and explain the situation in another manner.

At the midterm of the semester, I asked her to reflect on the question, “How confident are you in the content that you have taught this semester and will teach the rest of the semester?” She said, “I am pretty confident. I enjoy the materials presented in the book.” Interviews were conducted during the last full week of the semester. I reminded Melanie of the responses she had given regarding her confidence in her teaching. I then asked her, “What are you thinking now?” She replied, “I actually like teaching (general biology) because it covers so much and it is the basics of biology if you understand the basics then you can get more in detail, so I love it, it’s a good class.”

Jim. The night before Jim taught his second-semester general chemistry lab for the first time, he was asked to reflect and write about his confidence in teaching. The reflection question was, “How confident are you in the content that you will teach tomorrow?” Jim replied, “The material is not difficult for the first lab so I should be fine. Future experiments are more involved and cover material I have not studied in several
years. I am more nervous about those experiments.” During the interview, I followed up on that statement by asking him how it worked out for him. He said,

The material was never that bad, but in my own mind there are some things I was not as proficient with, but compared to the freshman students who have never seen it before, I was still hopeful. Like electro-chemistry is not my favorite but I could explain. That was the good thing about the (G)TA meetings, because the lab supervisor would go over the information with me.

Then, the night after teaching the first lab, I asked him if he had the knowledge and skills necessary to effectively teach his course. He wrote,

I do. I did well in my freshman chemistry classes. They were a long time ago, but it has been relatively easy to refresh my memory when it comes to the material. I was able to answer the students’ questions with little difficulty.

At the midterm of the semester, I asked him to reflect on the question, “How confident are you in the content that you have taught this semester and will teach the rest of the semester?” He said,

I am pretty confident in the material covered so far in lab. Recently, our lab has been performing acid/base titrations, which I did extensively in my analytical chemistry lab. I think covering material I have personal experience with really improves my teaching of the subject.

Interviews were conducted during the last full week of the semester. I reminded Jim of the responses he had given regarding his confidence in his teaching. I then asked him, “What are you thinking now?” He replied,
If I have done that particular experiment I can help better, from personal experiences I can help them. If students are like, why didn’t this work, especially with things like a titration. I had done that so I could tell them little tricks on what to do for a better end point and hopefully that could help them in analytical chemistry.

*Tina.* The night before Tina taught her lab for the first time, I asked her to reflect and write about her confidence in teaching. The reflection question was, “How confident are you in the content that you will teach tomorrow?” Tina replied, “I am very confident. Our first lab is on density, which is a very simple topic for me. Because I have taught the lab before (in two different sections), I have a good grasp on the issues that may confuse students.”

Then, the night after teaching the first lab, I asked her if she had the knowledge and skills necessary to effectively teach her course. She wrote,

Definitely. I am teaching the first-semester general chemistry (lab). My educational background is chemistry. I have my B.S. in chemistry with an emphasis in biochemistry. I am confident of my knowledge of the content. Of course, being able to teach does require more than just knowledge of the content. However, I am also confident I can convey my knowledge to the students in a personal way that will matter and make sense to them [at least on a one-to-one basis]. Teaching a lab, in my opinion, has two parts. First, I teach the class as a whole. I mainly introduce the topic, give a little background and then review what the lab will entail that day. I review any parts I feel will be difficult, or have
proven to be places that students were confused in previous years. While I’m confident that I am presenting the information clearly, I am not too certain of how effective the actual time spent is. The second form of teaching comes after the pre-lab instructions when students begin their work. This is the part that makes me question how effectively I am teaching in the introduction. This week, a couple of the questions I addressed in the pre-lab came back up once students began the lab. A large number of students were able to complete the lab without any further questions, other than a couple to clarify directions. However, I still had a few that really didn’t seem to get what I said in pre-lab. I would say approximately 25% of each class required extra, intensive help with some part of the lab calculations. With these students, I find each one needs me to present the material in a different way. Usually my first (or second, or even third) explanation still doesn’t help the student to understand, but I do eventually find a way to help direct them to the answer, rather than just answering their question for them. I still definitely run into challenges and obstacles; however, I would say I am competent to effectively teach this course, if not just for the sheer fact that I never stop trying. If a student doesn’t get it the first time, I don’t just give the answer. I continue to try and find another way for them to figure it out for themselves. It would be nice if I could find a way to reach these students in the larger forum (pre-lab time), but I’m not sure how that could happen or if it’s possible.
At the midterm of the semester, I asked her to reflect on the question, “How confident are you in the content that you have taught this semester and will teach the rest of the semester?” She said,

I am very confident in the content. As one of the three (G)TAs (along with five or so undergraduate TAs), I feel that I am well-prepared to teach lab each week both outright and in comparison to our first year (G)TAs. I know my content; I also know information beyond the content we require the students to understand. This is useful because I have a couple of students that like to ask other questions; it’s nice to be able to give them answers.

Interviews were conducted during the last full week of the semester. I reminded Tina of the responses she had given regarding her confidence in her teaching. I then asked her, “What are you thinking now?” She replied,

First semester I was terrified; as a student I taught others in the lab. I didn’t realize that I could teach, I didn’t make that connection until in the lab as the (G)TA. When I first taught for every lab that we taught we had to do one hour of tutorial time, which increased my confidence since I realized I had the ability to do the work. I have lots of ideas of what I want to do, but I don’t have the confidence they will work, so talking to other (G)TAs, my peers, have helped me by bouncing ideas off of them and realizing that my ideas are good has helped increase my confidence by talking to more experienced (G)TAs, more seasoned (G)TAs.
Mandy. The night before Mandy taught the general chemistry lab for the first time, I asked her to reflect and write about her confidence in teaching. She replied,

I am very confident in the material I am teaching tomorrow. It is material that I have learned in several different courses and laboratory classes. I have also gone over my lecture notes several times to refresh my memory on the subject.

Then, the night after teaching the first lab, I asked her if she had the knowledge and skills necessary to effectively teach her course. She wrote,

Yes. During both the training workshop and the (G)TA section meetings, I was given information that helped me become more confident to teach. I have taken this course (general chemistry) before, so I am familiar with the material. I have also taken the general chemistry lab, which is helpful because I have done many similar experiments before.

At the midterm of the semester, I asked her to reflect on the question, “How confident are you in the content that you have taught this semester and will teach the rest of the semester?” She said,

Overall, I am very confident in the content I have taught this semester. There have been instances where I have not understood small parts of the different labs, but I have discussed them with other teaching assistants before teaching it, and understood it. I am fairly confident in the material for the rest of the semester because it is material that I have had to learn many times before.
Interviews were conducted during the last full week of the semester. I reminded Mandy of the responses she had given regarding her confidence in her teaching. I then asked her, “What are you thinking now?” She replied,

Having done the work before helped me with my confidence level. Even if you didn’t do the same experiments, I knew in general what was supposed to happen and what we were supposed to do since I have a good background.

Research Question 4: How much support do the Graduate Teaching Assistants perceive they need in teaching and professional development?

After the graduate teaching assistant (GTA) participants taught their lab for the first time, they were asked to reflect and write about several aspects of their teaching. One of the support reflection questions was, “What type of support do you perceive you will need [if any] to effectively teach this course?” At midterm, the respondents were asked, “Have you received the support you have needed this semester to effectively teach the course?” During the interview the last week of the semester, they were asked to reflect upon their statements made during the semester and to think about what kind of support they perceive they need now to effectively teach the course. The responses from each GTA are now presented.

Maggie. The night after Maggie taught her first lab, I asked her what type of support she thought she would need to effectively teach the general botany lab. Maggie replied, “I will need the support of the instructor of record to effectively teach this course. We will make sure everything discussed in lab will first be discussed in lecture.” At midterm she replied, “I needed more support but since there is a new lecturer and [G]TA,
I didn’t get as much support as I would have otherwise. I feel I effectively taught the material but could use more support in prepping.” During the interview, she was asked to elaborate. She replied,

Basically since the instructor of record was coming in and didn’t know how anything was set up or run I told him what we had done in the past. With the new (G)TA it would be hard to get together because you can’t talk and prep since she didn’t know anything. At the end of the week I had to de-prep everything too, so I was the coordinator, teacher, prep person, etc; it was a hard semester. The lecturer had no idea of what happened in the lab. Since the lecturer is long winded, he would fall behind so within the first month we were covering things in lab that he hadn’t covered in lecture so we were about two labs ahead we had to use lab time to make up for information they didn’t get in lecture.

During the interview, I asked her, “What are you thinking now? What kind of support do you need to make you a more effective/efficient teacher?” Maggie replied,

If we had somebody that would get paid ½ of a teaching assistantship to prep, that would be great. I would have loved to teach one and prep since we have so much paper work to grade. It would make a world of a difference actually, it would have freed up more time to work on the other experiments. It would also help if we had a lab book for the students. That is why we have to give them so many papers. It would be a huge undertaking but it would be worth it. I took it upon myself to make a Google site for Botany lab for students. With Google if you type in a name it might bring up a picture of a girl in a bikini or the wrong plant
so instead of having them find them themselves it would help if it had lots of pictures. If we had a lab manual I wouldn’t have to bother doing that; it was something new this semester and it worked out really well for them. Instead of sending out all of those emails I just posted info on the website.

Maggie was also asked, “What do you like about the support/supervision/freedom you have been given in your teaching this semester?” She replied,

I like how he started especially in the beginning. The way we talked about fungi first and then algae since it led to the land plants even though we had to switch some labs around. A month into it around midterm it became less of ‘what we would like to do’ to ‘what are you doing this week?’ I had to tell him so I think there could have been more structure between the two of us with the lab but I think it was in the way it happened. He was focusing on a lot of things and the lecture being new to teach that…but I liked having the freedom and wish it hadn’t been the last semester since I was trying to finish my stuff. I could have done a lot more I probably would have created a lab manual.

I asked her, “What is ideal?” She relied,

As far as supervising, (I) definitely (would like) more interaction, more guidance from your supervisor. Like, I would like to do this and let’s make that happen. The freedom in that don’t have to say this is how it is done – talk to them, say this, okay see you later. I like having the freedom, it is structured, we had meetings with you, and we knew what to say what to go over but had the freedom
to do our own things, go off on our own tangent. There should be an equal
tbalance (instead of all freedom) between the two.

*Sam.* The night after teaching lab the first time, I asked Sam to reflect on the
question, “What type of support do you perceive you will need [if any] to effectively
teach this course?” She replied,

I receive some support from the professor during class (we are both usually
present during lab periods), but not much in the form of preparation (which I
would actually prefer). Much of what I have learned about this course has been
through merely experiencing it, rather than witnessing demonstrations of
dissections, techniques, etc. Consequently, if there is a question in which I do not
know the answer, I usually defer to the professor rather than lead the student
down the incorrect path. I hope I will have to use that option less this year.

At midterm I asked her if she had received the support she has needed this
semester to effectively teach the course? She said,

This is difficult to answer because I am not sure how much support I really need.
The major professor informs me of the lab schedule (which changes on a daily
basis) and I do what needs to be done for any given date (e.g., prepare/acquire
specimens, dispose of specimens, etc.). If I have questions in class, he provides
proficient answers, but I have received very little ‘hand holding’ in this course. I
assume he is pleased with my performance, as I have been left to teach several
classes on my own this semester (two of which were unplanned). So, yes, I guess
I do receive the support I need from the major professor to help students. I just have to do a lot of extra work on my own to be prepared.

During the interviewed, I asked Sam, “Why do you think he does this?” She replied,

I honestly don’t know since I don’t know him that well. My major advisor found out quickly that sink or swim works well with me. Perhaps the instructor of record got the same vibe or he looked at my transcript and realized I didn’t need much more help. However, I had never taken this lab and had only done two of the dissections as an undergrad. I had opportunity for serious refreshment. It works so it is okay. I don’t know if this is just how he deals with graduate students or what. It works, I am not angry, I would like more of a schedule a little bit more rigidity.

When I asked, “What are you thinking now? What kind of support do you need to make you a more effective/efficient teacher?” she replied,

If I was to train a (G)TA for the first time, before every class before every dissection I would take them through an entire dissection. I would do this for two reasons: 1) if you have a nervous graduate student it would be good 2), I would like a refresher for (G)TA and professor, and 3) you would have a pristine specimen already dissected since the students totally butcher theirs; you have a model specimen that is something I would do differently.

I then asked Sam what she liked about the support/supervision/freedom she had been given in her teaching. She said,
Support - It is a challenge. Kind of like that I don’t have the support; perceive that professor trusts me. I was left alone quite a few class periods and I sucked it up and got it done. Makes me work harder. He never told me expectations for lab; like if he just wanted someone to clean up or have someone actually teach the material. Freedom – it is freedom within bounds since he is present. I worry that I might have explained something incorrectly. He is there as the back-up in those situations. I like the freedom but also enjoy knowing that if I mess up, there is a safety net for instructional support, which I hate to have to ask for.

Finally, I asked her what she considered ideal. She replied, Emulate major advisor since she spends a great deal of time and she has kind of led me along where I have assisted her in some courses and when she thought I had reached a level, she has allowed me to lecture and have given four lectures this semester alone. The fact that there is confidence in my teaching is good; it has been an effective teaching tool. You can show someone how to do things and they can take from it what they want. I have seen how professors do things and I can pick what I like from that. Things able to have a broad array of experience emulating things from different professors; should base supervision on person-to-person basis. Someone without experience might need a little more assistance; for someone with experience, you can kick it up a notch.

Melanie. The night after teaching lab the first time, I asked Melanie to reflect on the question, “What type of support do you perceive you will need [if any] to effectively teach this course?” She replied,
Prep meetings are a great source of support. Not only do we go over the information but talking with my peers helps me with concerns I have as well as relating to concerns they have. At midterm, I asked her if she had received the support needed this semester to effectively teach the course. She said, “Yes, I have. The prep meetings, interacting with my peers, and prior experience of teaching the course has given me the support I needed to teach the course.

When I interviewed Melanie, I asked her what she was thinking now. She replied,

I actually really do enjoy the prep meetings even though I have taught the lab so many times. It forces you to think about the material before you teach it. If I didn’t have the prep meetings people would skim the material and might forget things. The main points are always addressed. Some interactions with peers are positive and some are negative. If you have people who want to be there; who enjoy teaching; if have people who are just teaching for a job then it becomes annoying, because I like teaching. Prep meetings are very good because then it also prepares lab for you, don’t have to worry about supplies. It also puts you in the students’ shoes as well because the lab coordinator asks questions and you have to know answers. In the beginning I hated that but now it is a good thing if asking questions it gives good ideas of what to ask your own students. You get all of these ideas and mimic what you are seeing.

I then asked her what kind of support she thinks she needs to make her a more effective/efficient teacher. She said,
I think I wish I had more of a structural background. I wish someone...there was a course that taught me how to structure a class – here is how you make goals and this is what is important – how to structure your teaching, the main points, how to apply different methods of teaching. The lab manual kind of forces you to do this because they have to use hypothesis/prior knowledge; the lab manual helps that – how to be efficient in teaching. If I am efficient I can check this off because I did that. Write myself a paragraph after each lab about how I helped myself. This would help increase confidence.

I completed the interview by asking her to describe what she likes about the support/supervision/freedom she has been given in her teaching. She said,

Even though I have to go over vocabularies and things, I also think I like to bring in the actual people who are doing the research. For example, how did cells come about? making sure they know historical perspectives; holistic view not just simplistic view; like to keep reiterating ideas; repetition is how you memorize things; experience has helped with this; details about enzymes and where they are found and how they help us; like digest, for example helping us break things down. The more I teach it the more interested I get in it.” I then asked why it is ideal. She said, “Prep meetings, peer interactions, own research, current research; just memorizing the book doesn’t make you a good teacher; if I am interested my students are interested.
Jim. The night after teaching lab the first time, I asked Jim to reflect on the question, “what type of support do you perceive you will need [if any] to effectively teach general chemistry labs?” He replied,

I will need the support of the lab supervisor. She is in charge of the freshman labs and conducts weekly (G)TA meetings, in which she goes over the material and addresses any questions I may have. I find these meetings invaluable as she has tremendous experience when it comes to laboratory practices.

At midterm I asked him if he had received the support necessary to effectively teach labs this semester. He said,

I have received great support from our lab coordinator. Her (G)TA meetings are very effective in explaining the laboratory procedures. My research advisors and lab mates are also very understanding of the time commitments required for me to teach.

When I interviewed Jim, I asked him what he was thinking now. He said,

Still think I received the support needed. It would have been much, much more difficult without my lab supervisor. If I had to figure out what was going on it would have been a nightmare; especially for the Tuesday lab; it would have been a practice round; you can imagine; if there was anything atypical, she would show us how to do that. We would do the experiments during the prep meeting especially if we had to do a hot filtration so that it was safe.

I then asked him what kind of support he needed to make him a more effective/efficient teacher. He said,
I received the necessary support for teaching. My biggest concern would be my research advisor, he is very demanding. He would say, ‘Nobody expects you to publish anything next week with all of the work you have’; he wasn’t expecting me to commit fully to research so that was a big help; knowing that he knew that was a big help.

Finally, I asked Jim what he liked about the support/supervision/freedom he had been given in his teaching. He said,

I was given considerable freedom in my teaching. My lab supervisor only stopped by a few times she didn’t hover over us. I enjoyed that aspect I still need the support, I need to know what is going on but if I explain something one way – when doing the Chatelier’s principle – her explanation is different from mine.

Tina. The night after teaching lab the first time, I asked Tina to reflect on the question, “what type of support do you perceive you will need [if any] to effectively teach general chemistry lab?” She replied,

Just from previous experience, I would say the biggest support I need is other teachers that I can talk to about problems that come up on a day to day basis. I work in an office with a graduate student that has been teaching labs for years, and I also have a number of other peers that teach, including one that teaches the same lab as me. Their support in listening and giving advice on issues that arise is very valuable. It’s also nice that they are my equal and not in a supervisory positive above me; this equality helps to increase the likelihood that I will approach them with a problem I am having with a student.
At midterm, she was asked to reflect on the question, “Have you received the support you have needed this semester to effectively teach the course?” She said,

I feel I have received almost all of the support I needed this semester. There are a couple of instances where I felt like the main reason I was prepared to teach was because of information I learned last year, not in this year’s preparation meeting. However, I don’t think it’s that I have had enough support as much as I preferred a different style of support.

During the interview I asked Tina to elaborate. She said,

We received more content the first semester, not necessarily things we would use in lab, just background information that you would need to know in case students ask questions; this semester, prep meetings were on a need to know basis. That worked for me because I just needed a review but there are many first year (G)TAs; usually not a big deal, but would have been nice to actually do lab experiment the first time had taught; supervisor this semester has a different style of preparing them. At midterm, Tina also said, “While last year’s preparation meetings were sometimes exhaustive, some of the information given in those meetings was very useful. This year feels a little more need-to-know; which, again, isn’t necessarily bad as much as it is not my preference.

During the interview, I asked her to elaborate. She said, “Just a different style. I like that I have had both because I am using all of the information. It gives me more tools.” I also asked her what she liked about the support/supervision/freedom she had been given in her teaching. She said,
I don’t receive as much supervision as I would like. I would like feedback so I can constantly get better. The chair of the department’s portfolio feedback was good; he gets to see the product of my work. Two examples of using a rubric – at midterm turned in and at end of semester. We had to write a teaching philosophy and job description…. would like more supervision; would like to receive feedback; I would like someone to observe so that I can get feedback on how I am doing. I wish we could make own lab quizzes. The questions are well written i.e., at different levels of Bloom’s taxonomy. We don’t see the quiz before so I give them some hints right before the quiz. I understand why do it for consistency.

Mandy. The night after teaching lab the first time, I asked Mandy to reflect on the question, “what type of support do you perceive you will need [if any] to effectively teach general chemistry lab?” She replied,

I think no matter what you do it is important to have the support of your supervisor for any questions you might have. I think I will be looking to my supervisor and other (G)TA’s (who have taught before) throughout the semester as a reference and a guide to effectively teach this course.

At midterm I asked her to reflect on the question, “Have you received the support you have needed this semester to effectively teach the course?” She said,

Yes. I have had support from other teaching assistants and the lab supervisor. Any time I have a question about the material or the lab, I can talk to them and figure it out. The (G)TA’s who have taught before have also been of great help because they have already taught this course and know generally what to expect.
During the interview, I asked her if she felt like she got that support. She said, I definitely received the support needed. There were two labs that didn’t go as planned and I talked to two seasoned (G)TAs about it. They said their students were having trouble as well, so it made me feel better to find out it wasn’t me but the lab.

I also asked her what other advice they have given you. She said, Some of it was lab procedures; one girl told me generally how she grades and it was similar to mine, so pointers on grading and being fair; how to handle situations like students missing a lab. Situations she had already encountered that I was encountering for the first time.

I also asked her what kind of support she needs to be a more effective/efficient teacher. She replied, It might have been helpful to sit in on a lecture every once in a while so I knew where they were in class; or go talk to a general chemistry professor which would be hard since they are hard to track down, since there are three different classes. It would be good to know what the students had covered in lecture before lab would allow you to tailor your teaching to their needs. Could ask questions of students to find out what they know about the topic; maybe in pre-lab lecture.

I finalized the interview by asking, “What do you like about the support/supervision/freedom you have been given in your teaching?” She said, Supervisor – we have our (G)TA meetings on Friday; she goes through lab and explain step by step and shows us what to do. That helps me since I like to see
things and then I have the whole weekend to sit and prepare for the next lab. It is nice to have others around same age as me so they aren’t as intimidating to me…easy to talk to; can go over lab things that might have gone wrong. I think I have a decent amount of freedom. The supervisor gives us information about what we are covering but I have to do a background work, an application, and I have that freedom. We have to cover say these three things so as long as you do that, it is okay. She may walk through the lab but I am still in charge of the lab.

Was this ideal? “Yes, because it really helps me learn different teaching methods and how I could improve my presentation of the material. I guess it was reflected in their grades.”
Preparation for Teaching

The night before the GTA participants taught their lab for the first time, they were asked to reflect and write about their preparation for teaching. The first reflection question was, “Describe what you did to prepare for teaching lab tomorrow.” The night after teaching the first lab, GTAs were asked to reflect on the question, “Were you well prepared to teach your course today? Explain.” At the midpoint of the semester, GTAs were asked to reflect on the statement, Describe how your preparation for teaching lab has changed since the first lab of the semester. If it hasn’t changed, speculate what you could do to be better prepared. The responses from each GTA are now presented.

Maggie. Maggie, the most experienced GTA replied,

Since there is a new instructor, I met with him earlier this week for over two hours discussing this week and a few future weeks of lab. I have reviewed my PPT, my teaching notes, and the new syllabus he has prepared. I have notes I wrote to discuss lab behavior, quiz policy, etc. to discuss the first lab as well. The night after teaching the first lab, GTAs were asked to reflect on the question, “Were you well prepared to teach your course today? Explain.” Maggie responded,

I was very well prepared to teach the course today. I had gone over the syllabus and notes I wanted to include in the first day talk. I reviewed my lecture notes and had to improvise a lot. We traveled to Buttercup Flats in Wiggins to look at the diversity of plants including several carnivorous plants so I had a set talk about the pine belt and then answered questions about our area and talked about plants and fun facts about them as we found them.
During the interview, I reminded her of this statement and asked,” Why did you have to improvise?” She replied,

We usually go to Wiggins the last lab, we do an ecology exercise out there; he wanted to go out there and then do the ecology exercise at Lake Thoreau, which of course never happened. I had to improvise because it was last minute and there is a difference in first lab and last lab; not knowing what plants were out there since it was a different time of year; lot of talking instead of an experiment since they hadn’t seen any of the plants. I had never been out there that early in the season. Lots of things we usually see in fruit were not, many were not blooming, fruiting; etc.

At the midpoint of the semester, GTAs were asked to reflect on the statement, Describe how your preparation for teaching lab has changed since the first lab of the semester. If it hasn’t changed, speculate what you could do to be better prepared. Maggie responded,

I dedicate many hours preparing for upcoming labs. I believe I prepare more now because I have to prepare the other teaching assistant as well. I have to be one step ahead to tell the lecturer what items we need for the following lab. I’m basically the lab coordinator, lab prep, and teaching assistant this semester. During the interview, she elaborated by saying,

The only thing I changed was that I didn’t discuss with the instructor of record as much – since he made the syllabus he knew what we were going to cover. I didn’t think I …that was the only thing I switched up, other than, we need carrots;
that was the only conversation we had about the actual lab. We are giving the practical next week (finals week). This will be the first time we are giving a practical the way it is supposed to be given with stations set up on the tables. I haven’t finished creating it because the other (G)TA says to do it however I want to do it. The instructor is leaving it up to me. He wants to kind of know what is on it and he asked me to cover certain things, but I am pretty much free to do whatever. In the past it has been all PPT, picture after picture; in the past I would have about four live things. He wanted more live things so we have about 20 live things. It was all multiple choice and there are people I know are struggling that did well so I think they are good guessers so, everything is going to be live unless it is something I can’t get and then they will get a picture. A real practical – (general biology II) was a real practical up to par with what a real practical should be; this is an upper level class so there should be a real practical.

*Sam.* The night before Sam taught comparative anatomy lab the first time, she took the time to reflect upon the question, “Describe what you did to prepare for teaching lab tomorrow.” Sam said,

I usually devote 2-6 hours towards preparation for every lab within this course. This might include performing a dissection ahead of class, acquiring specimens, and I am always re-reading and supplementing notes. This particular lab required me to acquire numerous specimens from the museum and I have made additional notes for various vertebrate groups that I would like to incorporate during the class period. As far as classroom preparation for this lab, I always make sure
specimens are displayed throughout the classroom in an organized, efficient manner that facilitates student movement through the stations. Photocopies of notes listing taxonomic hierarchies are also usually provided.

The night after teaching the first lab, I asked Sam to reflect on the question, “Were you well prepared to teach your course today? Explain.” She responded,

Yes, I was. The first lab in this course is driven by student inquiry as they examine specimens from various vertebrate groups and I am always fearful of being unable to answer questions (one cannot know everything about every organism!). However, I felt comfortable with most of the material and I believe that was visible to the students as most seemed as eager to ask me questions as they were the professor. I just hope this continues.

During the interview, I asked Sam if this continued all semester. She said, It did, the first semester it was obvious that it was the first time to teach the lab. The instructor told the students that I was new but that I knew techniques. Felt like had to keep up this semester a little more. The professor and I worked together and I hate to be the one seen as the weaker one so it was nice this semester to work together on dissections.

At the midpoint of the semester, GTAs were asked to reflect on the statement, Describe how your preparation for teaching lab has changed since the first lab of the semester. If it hasn’t changed, speculate what you could do to be better prepared. Sam responded,
Lab prep has not changed much. I arrive early on lab days to make sure specimens and utensils are ready for students. Much of my outside prep work involves using on-line sites for refreshers and glancing over past notes. I believe that I would be much better prepared if I was able to dissect specimens ahead of time to perfect techniques that give me difficulty. However, many specimens are expensive, so the opportunity to dissect one outside of class does not present itself often.

At end of the semester she still feels the same way. She said there were some left over specimens from the semester that she would dissect next fall to use in the lab for her preparation and for demonstration purposes.

Before every class in the fall I am going to make time to put specimens out and have things displayed. I told him that next fall I am going to totally dissect a cat and tease out things. I like to refresh material before a class.

*Melanie.* The night before Melanie taught general biology lab for the first time, she was asked to reflect and write about several aspects of her preparation for teaching. The first reflection question was, “Describe what you did to prepare for teaching lab tomorrow.” Melanie, the third most experienced GTA replied, “I have read through the lab manual again. I went through the powerpoint to make sure that each point is clear. Reviewed notes I have given myself through the years.” The night after teaching the first lab, GTAs were asked to reflect on the question, “Were you well prepared to teach your course today? Explain.” Melanie responded,
Yes, I was. I really went through the PowerPoint and made sure that I understood what I was trying to say to the students. I also came up with several situations/examples for areas I was sure that students would have trouble with. Examples: Dependent and Independent variables and control and control variables. I really thought about the terms and how to get it across clearly. I also found that through the years the more prepared I am the more excited I am about teaching the lab. Surprisingly, when I am excited I find that the students are not afraid to answer questions. I think that an exciting environment provides a security to be able to free their thoughts.

At the midpoint of the semester, GTAs were asked to reflect on the statement, Describe how your preparation for teaching lab has changed since the first lab of the semester. If it hasn’t changed, speculate what you could do to be better prepared. Melanie responded,

I find I focus less on reading the lab manual in detail. I usually skim over the text and any area I have highlighted. I also find that my curiosity and understanding for the subject matter increases every time I teach the class. Therefore, I feel that my explanations for the subject material are clear. I also had added a new part of prepping for the lab by venturing out to other resources to increase the knowledge and fun facts for the current lab.

During the interview I reminded Melanie of her reflective responses regarding preparation throughout the semester and then asked her if anything was different now? She said,
It’s the same. I find that in the beginning they are really intimidated. If I smile and let them know that it is okay and I am polite and calm, and they notice you enjoy it, then they will enjoy it. At first they hate me because I ask a million questions. By the end you have a good percentage of your class that would answer. I had a dominant student who would answer everything so I would say okay, somebody from the 4th table answer. I would switch it up so that she didn’t feel like she had to answer every question. By the end of it I think they really enjoyed the class. I have had students switch to Biology based on their experience in lab. I also let them talk and sometimes I put music on, I think it de-stresses them. If they ever have questions they feel I am approachable. I don’t let them talk about their private life to me. I stay out of that.

Jim. The night before the graduate teaching assistant (GTA) participants taught their lab for the first time, they were asked to reflect and write about several aspects of their preparation for teaching. The first reflection question was, “Describe what you did to prepare for teaching lab tomorrow.” Jim, the fourth most experienced GTA replied,

I listened intently during the (G)TA meeting and asked numerous questions to better my understanding of the laboratory procedures at this school. I received copies of all the laboratory materials and handouts beforehand and worked through the problems to be sure I understood them. I made a bulleted list of items to cover in my pre-lab lecture.

The night after teaching the first lab, GTAs were asked to reflect on the question, “Were you well prepared to teach your course today? Explain.” Jim responded,
I was well prepared as I had finished the assigned worksheet prior to teaching, so I could better answer the students’ questions. I thoroughly read the safety rules and made notes on what I needed to cover in my lecture, including formulas they would need to complete their assignment. I also reviewed some of the basic concepts I would be covering so I could better explain the material to the students.

At the midpoint of the semester, Jim was asked to reflect on the statement, “Describe how your preparation for teaching lab has changed since the first lab of the semester. If it hasn’t changed, speculate what you could do to be better prepared.” He responded,

My preparation for each lab is still fairly similar. I take notes during the pre-lab lecture and use those for my pre-lab lecture. I work the advanced study assignment so I can more effectively answer students’ questions. Recently I have begun reading through the procedure ahead of time and using estimated numbers, I work the calculations. This way I am better prepared if someone asks me a question during the lab.

During the interview I asked him if he used that procedure the rest of the semester. He said,

It didn’t change – always try to work advanced study assignment since they usually involved calculations that they had to do that day and usually students would have questions about it before they would turn it in. Once or twice I didn’t have a chance to do it and it made it a lot more difficult. I realized with my Tuesday lab would ask about how long it would take to do an experiment or what
am I doing here and I wouldn’t know; so I tried to go through the lab myself so that as they were going through the experiments I would know what they might need.

Tina. The night before the graduate teaching assistant (GTA) participants taught their lab for the first time, they were asked to reflect and write about several aspects of their preparation for teaching. The first reflection question was, “Describe what you did to prepare for teaching lab tomorrow.” Tina replied,

Today, I spoke with a girl who taught a lab section that occurs before mine to see if she had any specific problems. I also discussed the topic with another friend who gave me a couple of ideas on how to make the formula for density more memorable to students. Before teaching, I always make an outline of how I hope the class will go. I run through the class in my mind and take note of the information that I want to make sure I do not forget. As I play out the lab in my head, I also re-read through the lab manual to make sure I hit all the important points. This year, I tried to remember last year’s lab and the issues that students had once starting their work. I would have gone over my notes from last year, but I accidentally left them at home. Our lab requires that we have a preparation meeting the week before, so while I have already done the lab myself twice, I also had a refresher as the lab supervisor went through the lab again.

The night after teaching the first lab, GTAs were asked to reflect on the question, “Were you well prepared to teach your course today? Explain.” Tina responded,
Yes, I believe I was prepared as I could be. As far as the laboratory aspect, I knew the lab and was able to explain it sufficiently. I’m working this year on getting my students to speak up more in the pre-lab time. I tried a couple of methods, and I think they went well. Students participated more than in last year’s lab. The largest problem I had was enacting a couple of the rules that I decided to adopt this year, but those issues fall under classroom management. I had a large number of students that showed up with open toed shoes or without goggles. For safety, these students cannot stay in the lab. Last year, I let students borrow goggles, but because they took advantage of that, I decided this year to start fresh with the rule that goggles would not be available. Students had to leave to go purchase goggles or find shoes, thereby missing a significant part of the lab. Being the “bad guy” was probably the biggest challenge of both my classes. However, with my second section, I was a little bit more prepared for the reactions I would receive. Because I knew it was coming, I had already thought of the ways to respond that would help shift my role from “bad guy” to “law enforcer”. I’m still learning where I fall being both a student and a teacher.

At the midpoint of the semester, GTAs were asked to reflect on the statement, “Describe how your preparation for teaching lab has changed since the first lab of the semester. If it hasn’t changed, speculate what you could do to be better prepared.” Tina responded,

In some ways, my preparation hasn’t changed. On Mondays, I usually make contact with at least one of the Monday day-time (G)TAs to see how their lab
went. Since I teach night labs, it’s good to have an idea of any problems students are having with the lab, or any reagents/materials that are missing. I still make an outline of how I plan to present the material; however, this semester I have not re-read the labs. I have mostly reviewed the data sheet to make sure I remember all the parts. Each week I attend our weekly lab preparation meeting, where the supervisor reviews the lab. On a couple of occasions we have performed the lab to become more acquainted with the work our self. I really dislike teaching Monday labs because my Mondays are always very hectic and I feel like I’ve been less prepared this semester than last. Because I taught last year, I think I can get away with a little less preparation; however, I don’t like the feeling of getting in front of a group of students when all I understand is the content. I prefer to have planned how I will explain a topic, and practiced in my head a couple of times. I also like to think of more than one way to explain something. This semester I’ve probably been able to do that for 75% of the labs; I’ve really only had one or two labs where I felt I could have prepared a lot better. In these cases, I would have been better prepared if I had thought about the words I would use to explain something and the order in which I would explain it. While I understand everything the students need to know, it’s very important that I give the information to them in the most efficient and effective manner. If I’m not as prepared, I end up confusing them by jumping around.

Mandy. The night before Mandy taught general chemistry lab for the first time, she was asked to reflect and write about several aspects of her preparation for teaching.
The first reflection question was, “Describe what you did to prepare for teaching lab tomorrow.” Mandy, the least experienced GTA replied,

First, I read through the entire lab, including the introduction and the laboratory procedure. I then reread the experiment and made notes on important points to mention. From this I set up a general outline of things that I wanted to cover. After the weekly lab meeting, I completed my lecture notes with everything listed. I have been rereading the lab manual and the lecture notes in preparation to teach the lab tomorrow.

The night after teaching the first lab, GTAs were asked to reflect on the question, “Were you well prepared to teach your course today? Explain.” Mandy responded,

Although my notes were well prepared, I feel like I had not practiced my public speaking well enough. When in front of the class, I was very nervous. As time went on through the period, I became more confident and was able to relax and explain the pertinent information.

During the interview I asked her to elaborate on that statement. She said, For first lab I knew the material but wasn’t confident in explaining it to large group. Once they broke into groups it was better, I was able to go around and explain things why they were doing something. It helped me when I went through and saw each step they were doing and why they were doing it helped me. On the weeks where I didn’t reread everything I felt like I struggled and I might have missed a key point. It was a time issue when I had an exam or something; lack of time management.
At the midpoint of the semester, GTAs were asked to reflect on the statement, Describe how your preparation for teaching lab has changed since the first lab of the semester. If it hasn’t changed, speculate what you could do to be better prepared. Mandy responded,

Each week, I sit down on Thursday night to read the lab and do the advanced study assignment. On Friday, during the TA meeting, the supervisor goes over the procedure that the students will be doing in the lab. During that time I ask any questions I have about the lab, the advanced study assignment, and grading the lab. Over the weekend, I then review my notes, and mentally picture myself carrying out the experiment. I also do a set of sample calculations so that I know what the calculations should look like.

During the interview I asked her if that helps and she said it does. “I like to picture in my mind so I can know what it will look like, so I have a general idea of what I will look like setting the experiment up.”

A Typical Day Teaching Lab

During the interview participants were asked to describe a typical day teaching lab. Their responses are included below.

*Maggie.* Maggie said she usually arrives between 5 minutes to right on time before lab.

There is a class in there before ours and he usually runs over. If I have to get anything out I go about an hour before and make everything look okay, I leave and then come back right before lab. Once lab starts I pass out quizzes, entrance
quizzes are based some on lecture, some of lab information from the previous week – all written by the instructor. Toward the end since we didn’t coordinate as well it was usually questions from lecture only. I hand it out and give between 5 and 10 minutes, no longer than 10 minutes but it usually doesn’t take long. Then I hand back their entrance and exit quizzes from previous labs, give feedback, they get to keep them. I briefly tell them what we will do that day, reminders, and see if they have any questions. I start with PPT, I like to see if we are looking at something I will cover it, show pictures, then show specimens; make sure they know what they are looking at. I have done this before with Botany it doesn’t seem to work out at all. Toward the end, I go over main points of what we did that day, then I give an exit quiz that is up to me; 5 or 10 questions from what they did that day; things I went over and over that day; as long as they were paying attention they should get them. I gather it, they leave, and I update the website when the week is over.

Sam. Sam said

First you have to quantify what day lab will be on; if they are falling behind in lecture they will spend more time in lecture. Certain specimens have a certain amount of time; snake is only two days cat is much longer. Figure out lab day, make sure specimens are there and ready, look over notes and handouts with notes from prior semesters, find online dissection sites and use them as kind of a refresher. Also refer students to website, have supplementary texts, flip through
notes and generate more questions. That takes a little bit of time. I research information to show them I went the extra mile.

I asked her to describe a typical day teaching lab.

Get there about 15 – 20 minutes early; since it is an 8am lab, not many students arrive early. Desks are lined with paper; we share lab with anatomy lab so we try to keep it as clean as possible. Specimens brought out, if new day for new specimen, I give directions on best approach for dissection. Spend rest of time making sure everyone has what is needed and assist in needs of students. No lecture in this course it is all hands-on.

*Melanie.* Melanie said that every semester I have taught both of my classes on the same day. I usually teach at 11, when I get up I always like to dress like an adult; if I look more mature, then they are better able to separate me from them. I try to look older since I look young. I get to lab about 30 minutes early to make sure I am there to open door. I don’t like them to sit in the hallway. I go in, open the door and keep it open. I let them come in but while they are entering I clean the table and make sure the supplies are all available. I tell them they can ask as many questions as they want before class starts. If they don’t ask questions, I ask them questions to make sure they understand. Exactly at 11, I start the quiz; give 20 minutes, so they are not panicking. At 11:20, I collect quizzes, do five minute discussion sometimes it is 10 minutes; by 11:30 I am on the PPT which usually takes 20 minutes, might be repetitive, but I go over instructions in lab manual so they know exactly what to
do. They usually get out a little early, then I have about an hour to myself and then it all happens again.

**Jim.** Jim said,

I would arrive Tuesday a few minutes before (because my Protein class went until 15 minutes before lab), pick up quizzes from supervisor’s office. If students have questions on advanced study – supposed to do to prepare for quiz and the calculations in lab. I tried to start quiz right on time, allow 15 – 20 minutes for quiz, go through pre-lab lecture for however long 5 -15 or 20 minutes; probably not even 20; then you start the lab. Do experiments, then turn in data and they leave. I have the three papers I need.

**Tina.** Tina said on

Fridays have prep meeting with all (G)TAs and supervisor. Supervisor gives pre-lab lecture (introductory lecture) (equations we will use) to (G)TAs for use the next week; has equipment out and she does experiment or (G)TAs do experiment. Carry notebook with notes in margin and notes from first semester; don’t look at anything over the weekend. Mondays refresh memory and want to reread lab book I but don’t do it much. Make lab notes, an outline of what I will teach – this is included in Chairman’s portfolio too. Include reminders – lots of lists and notes. I arrive 15 – 30 minutes ahead of time. I get lab ready with one set up in front of the room; typically do experiments for the students first like a titration or when it is something they have never used. Acid reacting with metal has safety implications. Do demonstrations, answer questions for students as they arrive, do
advanced study assignment or pre-lab assignment; help some students if I perceive they have done the work already. I give the quiz at 6:30, when lab begins, I started pushing the time back since students started showing up late. I got stricter later in the semester; they turn in the quiz, then pre-lab begins and all students go to the front of the room. I go by notes and show equipment, spend 10–25 minutes for pre-lab. Lab doesn’t always follow lecture so sometimes lab is the first time they are seeing these things. Then they get started with work, once they start working I walk around the room to make sure students are doing work and can find everything. Usually they ask where things are located; students tend to ask same questions over and over. When that happens, I stop lab, tell everyone the answer, then students have data and have to analyze data doing math. Students have trouble with the math, typically; I don’t answer questions just ask them questions in reply, I ask leading questions. Students seemed receptive to this method since several asked if I was teaching the next chemistry lab they have to take. I also had some say, why don’t you just give us the answer. They then turn in work and leave.

*Mandy.* Mandy arrive about 5 minutes early because of class right before. I start to collect advance study assignments, allow them about 3 or 4 minutes to study look over notes. I give quiz, have about 15 minutes for the quiz. After that I go through my pre-lab lecture; background information, theory, application. I go through my notes then go through experiment - what supposed to do, what set-up should look like, what outcome is supposed to be. I
write formulas on the board; they get started and I walk around the room making sure they know what to do. I answer questions, and talk about previous weeks grades. They turn in work when finished and leave. It takes 2 – 2.5 hours.
CHAPTER V
DISCUSSION

During the past few years, GTAs have been prepared to teach by attending a daylong workshop that included logistical information but left pedagogy largely unexplored. Since that time, a seminar has been added to provide an introduction to pedagogical theory and practices and to provide practice teaching in the biological sciences laboratory course. Yet, more pedagogical preparation is needed. This study was conducted to determine if there was a need for a teaching certificate program for doctoral students in the College of Science and Technology. The idea is that training future faculty will have a great impact on STEM students and will make our graduates more prepared to join the professoriate. It will also instill the importance of professional development, ensure competent teaching staff and encourage interest in scientific careers.

This study was designed to answer the following research questions:

1. What are the graduate teaching assistants’ goals for teaching?
   a. Are the graduate teaching assistants’ goals for teaching different based on level of experience?

2. What pedagogical education and supervision do the graduate teaching assistants receive?

3. What is the perceived level of competence of graduate teaching assistants in teaching and professional development?
a. Are the perceived levels of competence of graduate teaching assistants in teaching and professional development different based on level of experience?

4. How much support do the graduate teaching assistants perceive they need in teaching and professional development?
   a. Is the support that graduate teaching assistants perceive they need in teaching and professional development different based on level of experience?

Two quantitative questionnaires, a series of qualitative reflections and interviews and an open-ended set of questions were disseminated for this study. The research included data collection of the participants’ teaching goals, level of teaching experience, perceived level of competence in teaching and professional development and perceived need for support in teaching and professional development. SPSS software was used to analyze the results of the questionnaires in relation to the experience levels of the graduate teaching assistants, which were arbitrarily set. Demographic data were also collected.

The study participants were graduate students in the CoST who were or had been on a teaching assistantship. Fifty-two percent of the respondents were male and 48% were female. Fifty point eight percent were biology graduate students, 22.2% were chemistry/biochemistry, 12.7% physics, 7% were in the Center for Science and Mathematics Education and 6.3% were in other disciplines. Sixty-seven percent of the respondents were Caucasian, 29% Asian, 1% Latino and 3% other ethnicities.
Research Question 1: What are the Graduate Teaching Assistants’ Goals for Teaching?

and

Research Question 1a: Are the Graduate Teaching Assistants’ Goals for Teaching Different Based on Level of Experience?

The Teaching Goals Inventory (TGI), a 52-item questionnaire, was designed to provide a self-assessment of goals for teaching based on what faculty think their students should achieve while enrolled in their courses. The six emerging themes were arranged in clusters as follows: Cluster I (CI) - higher-order thinking skills, Cluster II (CII) - basic academic success skills, Cluster III (CIII) - discipline-specific knowledge and skills, Cluster IV (CIV) - liberal arts and academic values, Cluster V (CV) - work and career preparation, and Cluster VI (CVI) - personal development. The purpose of the TGI is to provide a self-assessment of teaching goals to help faculty set goals and have something to strive toward as a teacher. Overall, the results of the TGI were not statistically significant based on level of teaching experience; however, many interesting outcomes resulted. Each of the goals was chosen as essential by at least one respondent and conversely all but two goals were chosen as unimportant by at least one respondent. The two rated by all respondents as important, very important or essential (i.e., not unimportant) were:

- Learn concepts and theories in this subject, and
- Develop ability to perform skillfully.

Appendix J includes all of the means, standard deviations, and percentages of TGI items (grouped by cluster) rated essential by respondents. The cluster with the highest
overall essential rating (43.8%) was Cluster I, Higher-order thinking skills followed by Cluster III, Discipline-specific knowledge and skills (29.9%). Cluster VI, Personal development was third (29.4%), Cluster V, Work and career preparation was fourth (28.9%), while Cluster II, Basic academic success skills was fifth (24.6%) and Cluster IV, Liberal art and academic values was sixth (14.0%). This is to be expected in a scientific discipline and is consistent with the finding of Angelo and Cross in their 1993 publication of their findings (Angelo & Cross, 1993, p. 366). In that study, faculty listed the following four goals among their top five:

- Develop the ability to apply principles and generalizations already learned to new problems and situations;
- Develop the capacity to think for oneself;
- Develop analytic skills; and
- Learn the terms and facts of the subject matter.

The authors of the study mention that those four goals are accepted components of higher education and the general public. The GTAs in this study listed the following five goals as their most important (in decreasing order):

- Learn concepts and theories in this subject (M = 4.34, SD = 0.72, % essential = 48.4%);
- Develop ability to synthesize and integrate information and ideas (M = 4.26 SD = 0.90, % essential = 50.0%);
- Develop problem-solving skills (M = 4.25 SD = 0.92, % essential = 47.6%);
• Develop ability to draw reasonable inferences from observations (M = 4.24 SD = 0.99, % essential = 53.2%); and

• Develop ability to think holistically: to see the whole as well as the parts (M = 4.22 SD = 0.81, % essential = 42.9%).

Four of those are grouped in the “Higher-order thinking skills” cluster and the other is in the “Discipline-specific knowledge and skills” cluster. This is to be expected when surveying graduate students in STEM programs (Angelo & Cross, 1993).

The goals that had the highest percentage of essential responses were:

• Develop ability to draw reasonable inferences from observations (% essential = 53.2%);

• Develop ability to synthesize and integrate information and ideas (% essential = 50.0%);

• Learn concepts and theories in this subject (% essential = 48.4%);

• Develop problem-solving skills (% essential = 47.6%);

• Learn terms and facts of this subject (% essential = 43.6%); and

• Cultivate an active commitment to honesty (% essential = 43.6%).

Interestingly, three of those are grouped in the “Higher-order thinking skills” cluster, two are in the “Discipline-specific knowledge and skills” cluster and one is in the “Personal development” cluster. These results, too, are to be expected.

Qualitative Research Question 1: What are the Graduate Teaching Assistants’ Goals for Teaching?
The night before the GTA participants taught their lab for the first time, they were asked to reflect and write about several aspects of their teaching. The first reflection question was, “What are your teaching goals for the semester?” The responses varied, but there were some common themes found among the GTAs. These included 1) effectively/clearly teach scientific content, 2) making the science have real-life applications, 3) develop good teaching techniques/speaking skills, 4) making science fun, 5) safety in the lab, 6) making connections and 7) improving writing/speaking skills.

Table 7 presents all of the responses to the question “What are your teaching goals for the semester?” The number and percentage of GTAs providing each response is included.

Table 7

*Summary of GTA Responses to the Question “What are Your Teaching Goals for the Semester?”*

<table>
<thead>
<tr>
<th>GTA goals for self</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectively/Clearly teach scientific content</td>
<td>5</td>
<td>83%</td>
</tr>
<tr>
<td>Making the science have real-life applications and interesting</td>
<td>3</td>
<td>50%</td>
</tr>
<tr>
<td>Develop good teaching techniques/speaking skills</td>
<td>2</td>
<td>33%</td>
</tr>
<tr>
<td>To be pleased with my teaching performance</td>
<td>1</td>
<td>17%</td>
</tr>
<tr>
<td>Be better prepared to teach material</td>
<td>1</td>
<td>17%</td>
</tr>
<tr>
<td>Enjoy teaching</td>
<td>1</td>
<td>17%</td>
</tr>
<tr>
<td>Increase confidence in teaching and classroom management</td>
<td>1</td>
<td>17%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GTA goals for students</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
</table>
The night after the GTAs taught their first lab I asked them if they thought they could accomplish their goals for the semester. All of the GTAs responded yes. At the midpoint in the semester, I again asked them to reflect on their teaching goals for the semester. I asked them if they had changed since the beginning of the semester. All of the GTAs said they did not think that their goals had changed since the beginning of the semester. Although, several did mention new goals they had developed based on their experiences this semester. Several of the GTAs stated that they continue to try to bring up current issues associated with the content they are teaching and try to make it fun and interesting. One even mentioned that students had provided feedback suggesting she was achieving her goal of being an effective teacher. One GTA suggested that he now has a goal of helping the students improve their writing skills after reading their lab reports. One GTA mentioned that she has added a goal to remove “acts that could be conceived as partiality”. Finally, one GTA mentioned that she wanted to learn from her students. She realized that since they all come from different academic backgrounds, she would need to figure out ways to communicate with all learners.
Interviews were conducted during the last week of the semester. I reminded GTAs of their reflective responses they had provided throughout the semester. I asked each of them to reflect on their goals for the semester and if they thought they had accomplished their goals. Four of the six GTAs replied that they thought they had achieved their teaching goals. Interestingly, the two that are the most experienced of the group were the ones who replied they were not 100% sure that they achieved their goals. Based on their responses, they both thought they had accomplished most of their goals, but both were still frustrated that students did not get 100% of their content material. Maggie wrote that her students still “could not make the connection”. Sam was still not 100% confident in the course and wanted to perfect it because she wants to teach comparative anatomy lecture when she joins the professoriate. All of the GTAs suggested at least one component of their teaching that could be improved the next time they teach the course. Many of the responses also indicated that they had gained confidence in their teaching since they were able to reach their goals. The GTA with no teaching experience prior to this semester indicated in her interview that she might want to pursue teaching as a career instead of research.

Research Question 2 - What Pedagogical Education and Supervision Do the Graduate Teaching Assistants Receive?

Pedagogical Education

To find out how much pedagogical education respondents received, an open-ended questionnaire was disseminated. Respondents were asked if they had any training to teach and if so, what type of training. The options for responses included 1) no, 2)
department training/workshop, 3) college training/workshop, 4) campus-wide training/workshop and 5) formal coursework. Respondents were asked to choose as many options that applied. Of the valid responses (N=63), 58.7% have had training while 41.3% have not. Of the almost 60% who have received some sort of training through a workshop or formal coursework, the largest percentage, 49.2% attended a workshop or training session put on by their department, 25.3% had some sort of formal coursework, while 19% had attended a college training or workshop and only 8% had attended a campus-wide training workshop. Since the respondents were asked to check all of the types of training or formal coursework they had received, there is some overlap. Based on research conducted by Lucas (2001) and published in *The Teaching Assistant Training Handbook*, departmental training is the optimum type of training since the information can be more specific to what the GTAs will encounter. Real-life applications that are discipline-specific might also be more helpful to GTAs who are learning how to teach. GTAs need to be taught how to effectively communicate within their own disciplines (Lucas, 2001; Nicklow et al., 2007), although, some topics do lend to cross-discipline training.

*Supervision*

Most GTAs receive some sort of supervision from a member in their department. Of the participants in this study, 74.6% are supervised when they teach, which means 25.4% are not supervised. This percentage is consistent with other studies (Prieto & Altmaier, 1994) and is not recommended for a successful GTA program. Unfortunately, according to data from several studies (Nyquist, Abbott, & Wulff, 1989; Prieto, 1994),
many GTAs actually accept teaching assistantships to help prepare them for careers in academia. If they are not supervised and thus, mentored along the way, they are probably not receiving the optimum training for being effective teachers (Prieto, 2001). Most (61.9%) have a weekly group meeting with their supervisor, while 25.4% have a group meeting with their peers once a week and 15.9% have individual meetings with their supervisors once a week.

Research Questions 3 and 4: What is the Perceived Level of Competence and Need for Support of Graduate Teaching Assistants in Teaching and Professional Development?

Of the responses to the questionnaire distributed, 68% reported that they were interested in a teaching position once they received their graduate degree and almost all of those were interested in teaching at a community college or university. These numbers are similar to the percentages reported from the survey conducted by Golde and Dore (2004) and published in Paths to the Professoriate. They reported that 63% of the graduate students surveyed were interested in a faculty job in the future. In the same study, of the three areas of the professoriate, graduate students replied that they were best prepared for a role as a researcher, rather than a teacher or for conducting any type of service activities. Of the prospective faculty who responded to the questionnaire, 74.2% were interested in conducting research, 71.7% were confident in their abilities and 65.1% thought their Ph.D. program had prepared them for this. However, only 42.9% reported being prepared to publish, but 52.4% were confident that they could, even if their programs did not prepare them effectively. While the focus of my study was not on
research of graduate students, I was interested in finding out some aspects of research associated with professional development, such as grant writing, developing a manuscript for publication and submitting a manuscript for publication. I was interested in finding out how competent graduate student perceive they are and how much support they think they need. My data indicate (see Appendix I) that graduate students do not perceive that they are very competent when it comes to developing a manuscript ($M = 2.70$, $SD = 1.27$), are less competent about submitting a manuscript for publication ($M = 2.61$, $SD = 1.32$) and even less competent when grant writing ($M = 2.27$, $SD = 1.29$). They also indicated that their highest need for support, out of all 37 items, is for grant writing ($M = 4.098$, $SD = 1.09$) with submitting a manuscript for publication the second highest area with need for support ($M = 3.74$, $SD = 1.30$), serving on a state committee ($M = 3.70$, $SD = 1.32$) as the third highest area with need for support and developing a manuscript for publication was what they perceived to be their fourth highest need ($M = 3.67$, $SD = 1.29$).

**Qualitative Research Question 3: What is the Perceived Level of Competence of Graduate Teaching Assistants in Teaching and Professional Development?**

The night before the graduate teaching assistant (GTA) participants taught their lab for the first time, they were asked to reflect and write about their confidence in teaching. The reflection question was, “How confident are you in the content that you will teach tomorrow?” Three GTAs replied that they were extremely confident while one was “fairly well prepared” since they had prior experience teaching the material. Two of the GTAs replied that they were nervous. One described that she was nervous because
during prior semesters she knew students would have trouble with some of the terminology. But, she also added that since she knew that ahead of time, she was able to better prepare herself for their questions. And one GTA was not nervous about the first lab but was for future labs covering experiments he had not done before.

The night after teaching the first lab, GTAs were asked a second reflection question about their teaching, “Do you think you have the knowledge and skills necessary to effectively teach your course? Explain.” All of the GTAs replied that they had the skills and knowledge to effectively teach the laboratory they were assigned to teach. Four of the GTAs stated that prior experience with teaching that lab has helped their confidence level for the lab. Four mentioned that prior coursework has provided the skills, while two stated that their own reading of scientific literature has helped and one who was teaching general botany lab conducted her Master’s research on the same topics she was teaching. So, prior experience is important to the confidence level of GTAs.

At the midpoint in the semester, GTAs were again asked to reflect on their competency level by responding to the question, “How confident are you in the content that you have taught this semester and will teach the rest of the semester?” Two of the GTAs were very confident in the content they had taught already and what they will teach. The GTA with the second most teaching experience says her confidence varies with the specimen she was dissecting at the time, while three of the GTAs described themselves as being pretty/fairly confident. One GTA (with no prior teaching experience) added that when material came up that she was not confident in teaching, she would discuss it with other GTAs and then she felt better.
Interviews were conducted during the last week of the semester. Participants were reminded of their reflective responses throughout the semester and then asked to reflect on their thoughts now that the semester was coming to an end. In some cases, GTAs were asked to elaborate on particular comments that warranted more explanation. All of the GTAs mentioned that experience has helped them teach this semester. A few also stated that discussing ideas and situations with peer GTAs helped their confidence in teaching as well. So, once again, experience is helpful when preparing to teach and actually teaching.

Qualitative Research Question 4: How much Support do the Graduate Teaching Assistants Perceive they Need in Teaching and Professional Development?

After the graduate teaching assistant (GTA) participants taught their lab for the first time, they were asked to reflect and write about several aspects of their teaching. One of the reflection questions [focused on support] was, “What type of support do you perceive you will need [if any] to effectively teach this course?” Five of the GTAs indicated that they would need the support of their instructor of record/lab supervisor. Half of the GTAs indicated that they would need the support of their peers who are currently teaching the same labs or have taught similar labs in the past.

At midterm, the respondents were asked, “Have you received the support you have needed this semester to effectively teach the course?” The reflections ranged from yes to no to almost. Three of the GTAs responded that they did receive the support needed during the semester. All three mentioned the support came from the lab supervisor and peers who are teaching the lab this semester as well. One stated, “The
prep meetings, interacting with my peers, and prior experience of teaching the course has given me the support I needed to teach the course.” One GTA responded that she needed more support. She thought she effectively taught the lab material but needed more help prepping the lab each week. Two GTAs responded that they *almost* received enough support. One stated that “yes, I guess I do receive the support I need from the major professor to help students. I just have to do a lot of extra work on my own to be prepared.”

During the interview the last week of the semester, respondents were asked to reflect upon the support they had received during the semester and if they liked the support they received. The responses varied greatly among the GTAs. Maggie thought that she needed much more support, especially in prepping the lab each week since it took so much of her time. She served as lab coordinator, teacher and prep person and it was overwhelmingly busy. She also thinks that she needs more lab materials for the students, like a lab manual, so they have a reference guide and she doesn’t have to supply handouts all semester. Sam liked her “freedom within bounds” since she always had the major professor to fall back on if there was an answer she did not know since he attended most of the labs. She will continue to gain confidence by emulating her major professor.

Melanie likes the weekly prep meetings since it makes her remain up-to-date with her teaching material. She responded,

Prep meetings are very good because then it also prepares lab for you, you don’t have to worry about supplies. It also puts you in the students’ shoes as well because the lab coordinator asks questions and you have to know answers. In the
beginning I hated that but now it is a good thing if asking questions it gives good ideas of what to ask your own students. You get all of these ideas and mimic what you are seeing.

She also wrote that she would like more of a “structural background.” I asked her to elaborate and she said,

I wish someone, there was a course that taught me how to structure a class – here is how you make goals and this is what is important – how to structure your teaching, the main points; how to apply different methods of teaching. The lab manual kind of forces you to do this because they have to use hypothesis prior knowledge the lab manual helps that – how to be efficient in teaching. If I am efficient I can check this off because I did that; write myself a paragraph after each lab about how I helped myself; this would help increase confidence too.

Two of the other three GTAs thought they had received enough support from their lab supervisor and peer GTAs. The other GTA wanted more supervision and more feedback on her teaching. She also suggested that she would like to have someone observe her teaching to provide some formal feedback. She had to complete a teaching portfolio as a requirement for her assistantship and she liked that. She thought the feedback she was provided would help her improve her teaching skills in the future.

When the GTAs were asked about their ideal situation regarding support, almost all suggested that they would like more practice before teaching and more supervision. Sam would like to complete all of her dissections prior to teaching the students and Mandy would like to sit in on the class lectures every once in a while. Tina really liked
the prep meetings the prior semester that were “sometimes exhaustive”, but very helpful to her teaching and ideally would like more supervision and feedback.

Preparation for Teaching

The night before the GTA participants taught their lab for the first time, they were asked to reflect and write about their preparation for teaching. The first reflection question was, “Describe what you did to prepare for teaching lab tomorrow.” All of the GTAs reviewed their notes and five attended prep meetings with their lab supervisor. Three of the GTAs organized an outline of their lecture while two of the others reviewed a PowerPoint lecture created during another semester. Two of the GTAs actually had to prepare the lab since they were the only ones teaching the lab that semester, while one also conducts the dissections when possible. And finally, one of the GTAs also consults her peers to discuss the lab before teaching.

The night after teaching the first lab, GTAs were asked to reflect on the question, “Were you well prepared to teach your course today? Explain.” The five GTAs with prior teaching experience all responded that they were well prepared to teach the lab. They all mentioned that prior experience had helped to prepare them for the first lab. The GTA with no teaching experience thought that although her notes for teaching were well prepared, she had not practiced public speaking enough and was “very nervous”. She responded that as the lab time progressed, she became more confident and relaxed and able to “explain the pertinent information”.

At the midpoint of the semester, GTAs were asked to reflect on the statement, “Describe how your preparation for teaching lab has changed since the first lab of the
semester. If it hasn’t changed, speculate what you could do to be better prepared.” Four of the GTAs responded that their preparation for lab had not changed much throughout the semester. The most experienced GTA said that she dedicated many hours preparing since she was mentoring another GTA who had never taught before. And one GTA says that she read the lab manual in less detail; however, since “my curiosity and understanding for the subject matter increases every time I teach the class…my explanations for the subject material are clear”. The same GTA also mentioned that she is using other resources to find “fun facts” for the lab.

During the interview, I asked the GTAs to describe a typical day teaching lab. Four of the GTAs arrived just a few minutes before teaching lab either because they were in class before or the room was occupied by a class right before their lab. The other two GTAs arrived anywhere from 15 to 30 minutes before lab. All of the labs except one required that the GTA administer a quiz during the first few minutes of lab and even one GTA gave quizzes at the end of lab each week. The one who does not administer a weekly quiz begins lab right away without a pre-lab lecture. She set up the lab by lining the desks with paper and placed the specimen(s) on the table. The students spent the entire lab time dissecting the specimen. Of the other five GTAs, three then reviewed quiz papers from the previous week while the other two performed a demonstration of the lab. After that, all of the GTAs delivered a PowerPoint presentation to introduce the topic for lab that day. The students then performed their lab, turned in their work and left.

*Summary of Qualitative Responses by Respondent*
Maggie was the most experienced GTA in the study with 12 semesters of teaching experience as a Master’s student. She taught the general botany laboratory. Her goals for the semester were to teach students about plant-related topics, discuss real-life applications of plants, help students find easy ways to remember information, help them make connections and see the bigger picture, and help them realize that science and plants can be fun. Her goals did not change all semester and she thought her prior experience in teaching other labs and taking classes had helped her come up with and share “easy” ways to remember ideas. She was also extremely confident in the content she was teaching since she had taught it four times prior and conducted research on plants. To effectively teach her course she thought she would need the support of the instructor of record and help setting up the lab. At the end of the semester she thought that she needed more support from the instructor and more support in prepping, although she thought she had effectively taught the material to the students.

Sam was the second most experienced GTA and taught four semesters as a doctoral student and six semesters as a Master’s student, for a total of 10 semesters of teaching experience. She taught the comparative anatomy laboratory. Since she was teaching the course for the second time, her goals no longer consisted of “merely surviving” or “staying ahead of the students”. She said that prior experience with the course ensured that those objectives would be met, allowing her to develop personal goals regarding her teaching methodology. During the semester her goals did not change but her reliance upon the major professor was greatly reduced and she was able to perform necessary techniques with greater skill through her experiences. Sam was
confident in the content she was going to teach since she had previous experience teaching that material. Sam received some support from the professor, but not much in the form of preparation. Much of what she learned about the course had been through experiencing it and through the extra work she had done on her own to be prepared.

Melanie was the third most experienced GTA with six semesters of teaching experience as a Master’s student and two semesters as an undergraduate, for a total of eight semesters. She taught the first semester of general biology laboratory. Her teaching goals included making sure that students would be able to understand all topics and be able to communicate scientific information. She also wanted to make sure that her students thought that science was fun and that everyday functions relate back to science. Before teaching the first lab of the semester, Melanie was nervous because “during prior semesters students would have trouble with some of the terminology. But, since I knew that ahead of time, I was able to better prepare myself for their questions...” However, she did think that she had the competence and necessary skills to teach since she had read scientific papers, watched documentaries on biology, and taught the lab several times. She thought that over the years of teaching, her confidence in front of the classroom has increased. Melanie liked the weekly prep meetings and thought they were a great source of support. She also liked to interact with her peers, and thought that prior experience of teaching the course had given her the support she needed to teach the course.

Jim taught four semesters as an undergraduate. This was his first semester to teach as a graduate student. He taught the second semester of general chemistry laboratory. His teaching goals included making sure his students understood the
purposes of the experiments they performed “since science is much more interesting when there is a purpose behind the procedures.” He was also concerned with safety in the lab since he was teaching a chemistry lab. He also set a goal for himself to improve his own teaching and public speaking skills. Jim did not think his teaching goals changed much although when formal lab reports were due, he decided a new goal was that he wanted to help his students learn to write more scientifically. So, through his experience, he realized the importance of improving writing skills. Midway through the semester Jim was pretty confident in the material covered so far in lab. The students had recently performed acid/base titrations, which he had done extensively in his analytical chemistry lab. He thought that covering material he had personal experience with really improved his teaching of the subject. Jim thought he would need the support of the lab supervisor to make it through the semester since she had tremendous experience with laboratory practices.

Tina taught one semester as a Master’s student. She taught the first semester of general chemistry laboratory. She developed teaching goals for her self which included increasing her confidence, providing better instruction and improving her classroom management. She also developed teaching goals for her students which included safety in the lab, improving math abilities and improving writing skills. She thought that her experience during the previous year had helped her identify the places students might get confused, thus allowing her to alter her lectures accordingly. She also thought that she gained experience in teaching and increased her confidence a lot. She also recognized that being able to teach requires more than just knowledge of the content.
Tina was very confident in the material she taught her first lab because she had taught the lab before and had a good grasp on the issues that may confuse students. She thought she had the competence and skills to teach the course because she had earned a B.S. in chemistry with an emphasis in biochemistry. She knew the subject matter beyond that required for teaching the course. Tina thought that the biggest support she needed was other teachers that she could talk to about problems that came up on a day to day basis. Just from previous experience, she knew that their support in listening and giving advice on issues that would arise would be valuable. At the end of the semester she thought she had received almost all of the support she needed. There were a couple of instances where she felt like the main reason she was prepared to teach was because of information she learned the previous year.

Mandy had no teaching experience at all prior to this study. She taught the first semester of general chemistry laboratory. Her teaching goals for this semester included aiding the students in understanding the lecture material, helping the students become more interested in the material and want to learn about chemistry. She also wanted to make the laboratory as fun and interesting as possible and make connections to real life. As the semester progressed and Mandy experienced more, she wanted to learn from the students, in addition to helping them learn. She realized that they all came from different backgrounds, and all had different methods of learning the material. In order for each of them to learn, she realized she must figure out different ways to communicate the course material so that they could all grasp the concepts. She also realized that she didn’t really want to go into research as much for her career and that she wanted to teach. For the first
lab, Mandy was very confident in the material since it was material that she had learned in several prior courses she had taken. She had also reviewed her lecture notes several times. Her prior experience with taking the course helped her throughout the semester although there had been instances where she did not understand; however, she discussed these parts with other teaching assistants prior to lab, which helped her understand them. Mandy thought that it was important to have the support of her supervisor for any questions she might have. She also thought that experienced TA’s could serve as a reference and a guide to effectively teach the course.

Conclusions

In summary, the common theme was that experience is important with setting goals for teaching. Experience is also important for gaining the confidence to relay the content in a manner in which the students understand it. Whether the experience is obtained during prior semesters of teaching, through conducting research or during the current semester is less important than the actual experience obtained. And furthermore, it is important that the GTAs use the information gained through experience to improve their teaching so that students have a better opportunity to retain what they have learned.

The GTA respondents have set teaching goals that are consistent with faculty members across the country by stating they think their students should: 1) learn concepts and theories in the subject, 2) develop the ability to synthesize and integrate information and ideas, 3) develop problem-solving skills, 4) develop the ability to draw reasonable inferences from observations, and 5) develop the ability to think holistically: to see the whole as well as the parts. However, this research goes further to find out how
competent the GTAs perceive they are with respect to teaching and professional
development. The GTAs do not differ in their perceived level of competence based on
experience level; however, this does not mean that they do not perceive they need
assistance in training to do many of the activities associated with teaching and
professional development (e.g., lowest reported perceived competence level was grant
writing with submitting a manuscript for publication second lowest). There is a also
direct association between the GTAs perceived level of competence and their perceived
need for support since the highest need was in grant writing and second highest need for
support was in submitting a manuscript for publication. Furthermore, since the GTAs
have indicated that they perceive they need support from their supervisor, professor or
experienced peers, and, since 68% responded that they were interested in a teaching
position once they received their graduate degree, the University should allocate time to
train and educate the GTAs who are currently teaching or plan to teach as a profession.
Therefore, it is recommended that the University provide ample training and supervision
to provide the opportunity to help GTAs develop a skill set that many CoST graduate
students currently lack when they graduate. Having knowledgeable people provide the
proper support to help GTAs teach more effectively is needed.

Recommendations for Certificate Program in College Science Teaching

Based on this research (and others e.g., Lucas, 2001; Nicklow et al., 2007), it is
recommended that the certificate in teaching program emanate from the office of the
College of Science and Technology. Graduate students may opt to receive a certificate in
college science teaching by completing the requirements for the program. These
requirements include four courses including the introduction to teaching in the CoST (Graduate teaching assistant workshop/orientation week and professional development seminar). The objectives of the certificate in teaching program include:

1. To enhance the quality of undergraduate teaching,
2. To provide teaching experiences to future academicians, and
3. To promote professional development of GTAs.

The certificate program proposal:

I. Teaching Methods I – An Introduction

   a. Organization
      i. Designing a syllabus
      ii. Choosing a textbook/laboratory manual
      iii. Preparing to teach/developing lectures
      iv. The first day of the semester

   b. An introduction to pedagogy
      i. Learning theories
         a. Constructivism
         b. Inquiry
      ii. Teaching strategies
         a. Think-pair-share
         b. Cooperative learning
      iii. Assessment
         a. Writing good test questions
b. Providing summative and formative feedback

II. Teaching Methods II – Preparing for the Professoriate

a. Searching for a job
   i. Community Colleges
   ii. Liberal Arts Colleges
   iii. Universities/Institutes of higher learning

b. Preparing for a job interview
   i. Developing a curriculum vita
   ii. Developing a teaching philosophy
   iii. Developing a plan of research
   iv. Good questions to ask
   v. How to prepare for the interview

c. Getting the job/Now what?
   i. Publish and prosper
   ii. 3rd year review
   iii. Tenure and promotion

III. Multiculturalism and Technology in the Classroom

a. Multiculturalism
   i. Multiple intelligences
   ii. Interpersonal skills
   iii. Cultural differences
   iv. Who are your students? (i.e., People born in 1991)
b. Technology in the classroom
   i. Current and available technologies
   ii. Technology for on-line teaching
   iii. Proper use of technology
   iv. What technologies your students have always known (i.e., People born in 1991)

IV. Teaching Practicum
   a. This consists of a supervised semester of teaching. The students teach a lecture or lab and complete a portfolio which contains sample lectures, quizzes, papers, and student evaluations. Doctoral students opting to earn the certificate should make arrangements with a member of their discipline for the teaching practicum.

   It seems that the GTAs studied have a set of goals for teaching that are consistent with faculty members across the country. The overwhelming theme that the GTAs share is the need and desire for supervision and feedback of their teaching. It is also quite evident that experience in teaching provides the self-confidence needed to successfully and efficiently lead a classroom of students. The challenge for the future members of the professoriate will be in the ability of the graduate students and future academician to balance research, teaching and service. By providing the means to better prepare for a career that potentially involves teaching, we will produce a better and more well-rounded doctoral graduate.
APPENDIX A

TEACHING ASSISTANT WORKSHOP BOOKLET

TEACHING ASSISTANT WORKSHOP
2009

DEPARTMENT OF BIOLOGICAL SCIENCES
DEPARTMENT OF CHEMISTRY/BIOCHEMISTRY
THE UNIVERSITY OF SOUTHERN MISSISSIPPI

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PROFESSIONAL DEVELOPMENT FOR SCIENCE
TEACHING ASSISTANTS
August 18, 2009

BIOLOGICAL SCIENCES LEARNING CENTER
MISSISSIPPI HALL

AGENDA

Morning Session
8:00  Breakfast, Welcome and Introductions
Overview of BSC 600 Professional Development for Teaching Assistants
Requirements and Expectations
Dr. Bob Bateman, Dr. Frank Moore & Aimée T. Lee

8:30  Expectations for Laboratory Teaching Assistants
Guidelines for Effective Teaching
The First Day of Lab
Establishing Rules and Procedures for Effective Classroom Management
   How to handle cheating and plagiarism
   Handling student confrontation, disruptive behavior, and sexual harassment
Cynthia Littlejohn & Trish McRee – Department of Biological Sciences

10:00 Break

10:15 Laboratory Safety, Lynn Landrum – Biosafety Officer
Student Health University Service, Dr. Virginia Crawford – Director of Health Services
Disability Policy, Suzy Hebert – Director of the Office for Disability Accommodations
University Police, University Police Officers
Fire Safety in the Laboratory, Kristi Marsh – Fire Safety Inspector

11:30 Ethics in College Teaching, Dr. Sam Bruton – Associate Professor, Philosophy and Religion

12:00 Lunch

Afternoon Session
12:45 Teaching College Science Laboratory Courses

1:00 How People Learn: The Science of Teaching Science and Characteristics of Learners, Aimée T. Lee-Instructor, Biological Sciences
1:30 Motivating Students to Learn How to Think, Dr. Sheila Hendry- Instructor, Center for Science and Mathematics Education

2:00 Break

2:15 Best Practices Panel Discussion led by experienced teaching assistants

3:00 Biological Sciences Graduate Student Information Session
   Dr. Frank Moore, Chair & Professor, Biological Sciences
   Dr. Shaio Wang, Associate Professor & Graduate Admission Committee Chair, Biological Sciences

   Biological Sciences 103L Teaching Assistant Information Session
   Aimée T. Lee, Instructor & Introductory Biology Laboratory Coordinator, Biological Sciences

3:55 Adjourn
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### INTRODUCTION
As a teaching assistant, you will be a representative of the Department of Biological Sciences or Department of Chemistry/Biochemistry and the University of Southern Mississippi. You are an important role model for undergraduate students and, as such, your position as a Teaching Assistant (TA) should be taken seriously.

You will be given a specific laboratory assignment by the Department Chair and the laboratory coordinators at the beginning of each semester and are responsible to the Laboratory Coordinator or the Instructor of Record for those labs. Depending upon the laboratory assignment, each TA’s responsibilities may vary from lab to lab and from semester to semester. Each TA will meet with the Laboratory Coordinator or with the Instructor of Record on a regular basis (weekly) to coordinate the laboratory exercises and carry out the required assignments. This handbook along with information discussed during the TA workshop will be the guide for you during your time at USM as a TA.

EXPECTATIONS FOR TEACHING ASSISTANTS

Personal Dress Code
While there is no mandatory dress code set forth by the Department of Biological Sciences or Department of Chemistry/Biochemistry for classroom teaching, TAs should adhere to the standards of good taste with respect to dress. Shorts, halter tops, T-shirts with inappropriate language and/or symbols, caps, short dresses or skirts, and torn clothing should not be worn. No open-toed shoes can be worn in Chemistry labs. TAs should also attend to their personal hygiene.

Oral/Written Communication with Undergraduate Students
TAs should exercise good judgment when speaking with and/or writing to undergraduate students. Foul language, inappropriate comments or inappropriate written messages will not be tolerated.

Other Expectations
The TA should always be on time for assigned laboratory sections (30 minutes prior to scheduled lab session), TA meetings and for appointments with students. The TA should be encouraging to students and should maintain a positive attitude while in lab and when dealing with students outside of class. It is important for the TA to be courteous and professional with students and co-workers. When talking with students about faculty members, the TA should always refer to the faculty member by their title. Since the TA is a representative of the Department and the University, it is important to reflect a professional demeanor and to remember that this is a job and the TA should behave accordingly. Please refrain from negative talk about the Department or University.
GUIDELINES FOR EFFECTIVE TEACHING

The following guidelines may help you to develop an effective teaching style.

1. Organize and prepare each class carefully
   a. Do not let the lecture component of your lab exceed ½ hour. This is a lab course, not a lecture course.
   b. Review and know the material well before you teach.
   c. Speak loudly, clearly and not too rapidly.
   d. Make eye contact with students.
   e. Avoid saying “you know” and “uh”.
   f. Outline the material and point out key ideas, definitions, concepts and principles.
   g. Develop analogies and examples to illustrate important concepts and principles.
   h. Use a computer, LCD/overhead projector or chalkboard to accompany your lab lecture.
   i. Summarize after each section of a lecture.
   j. Write down a few questions to ask students during the class period. Answers to the questions will let you know how well students understand the information.
   k. Periodically review main ideas and facts.
   l. Display enthusiasm for your subject matter. Students become involved and attentive when an enthusiastic lecturer has a clear delivery.

2. Care about your students as learners
   a. Establish a positive rapport with your students. Although learning and teaching can be difficult at times, classes should be upbeat and interesting.
   b. Come to class early and talk with your students. Students need to know that you are there to help and that you are a caring person.

3. Think ahead about how you might respond to various encounters.
   a. Avoid arguing in class with students about exam questions. Instead ask them to write down why they think their answer is correct and you will meet with them later to discuss it.
   b. Refrain from preaching to the class/individuals who do poorly on quizzes or exams.
   c. Avoid phrases like “Oh, this is trivial” as you proceed to fill the board with equations.
   d. Develop patience and empathize when your students have difficulty.

4. Listen carefully to student’s questions without interrupting even though you think you know
what they are trying to say.
   
a. Look at students after you have made a point even if it means seeing confused
   expressions and realizing your best explanation was not good enough! Find
   out
   how many are confused, what questions they have and plan to re-explain the
   ideas
   again at the next class meeting.
   
b. Do not blame either yourself or students when an occasional class period
   seems a disaster. Figure out, if you can, where the problems lie. In any case,
   teach the content again, preferably using a different strategy.
   
c. Be encouraging. Smile during class. Students appreciate good humor.
   
d. Correct wrong responses in class so that other students are clear about what is
   accurate, but do not indicate that answering a question wrong is terrible or
   laugh at the student’s answer.
   
e. Listen to a student’s complaints. Remember how you felt when you were an
   undergraduate.
   
5. Be Professional and Honest
   
a. Before the drop date, make an effort to meet with students who are not doing
   well in the class. Have a “see me” policy to discuss their grades and what
   their options are in the course. Encourage them to make informed decisions
   about their future.
   
b. Be firm, be fair, be consistent. This applies to the grading process, to
   classroom management, as well as to your general interactions with
   students.
   
c. Admit when you do not know the answer to questions rather than bluffing or
   brushing aside the question.
   
d. It is important to maintain a professional distance from your students. You
   must never become intimately involved with your students or overstep the
   bounds of propriety. TAs must not accept money for tutoring their own
   students (although you may tutor students in other classes or sections).
   
e. There are certain limits on class discussion of religion, sex or politics. It is
   improper for TAs (or any instructors) to convene classes in bars or off
   campus. You must operate within the fences of college regulations at all
   times. If you are unclear about what constitutes the standard morals at USM,
   ask your Instructor of Record or the Chair of the Department for clarification.
   
f. You must not publicly verbalize or demonstrate feelings of dissatisfaction
   with departmental personnel, lab equipment, facilities or policies. You are a
   representative of the University and it is not acceptable to “bad-mouth” your
   students either in their presence or in the presence of other TAs.
   
g. Have high expectations for yourself and for your students. Do not permit any
   behaviors that mitigate against this. Dozing in lab, reading the newspaper,
sitting on bench tops, “horse-play”, etc. must not be tolerated. Any “slacker” behavior is inappropriate and must be dealt with accordingly.

from *Handbook for Teaching Assistants at the University of Illinois*, 1998. Revised by Delia Anderson

**FIRST DAY OF LAB**

Begin the first day of lab by introducing yourself (you may wish to tell the students something about yourself). If the lab is small, you may have students introduce themselves. Hand out and read the syllabus, discussing each point thoroughly. Be very clear on all the policies and procedures. You should discuss the Departments’ policy on dual enrollment (lecture and laboratory).

Prior to the first day of lab, a syllabus should be prepared by the Laboratory Coordinator, Instructor of Record or the TA. It is important for the TA to discuss the contents of the syllabus with the students on the first day of lab so that they know what is expected of them.

**The Syllabus**  
The syllabus should include the following items:  
the Instructor of Record’s name  
the TA’s name, (business) phone number and/or email address  
the Departments Office number and hours  
lab manual title/author  
dates and laboratory exercises  
the lab website address  
course objectives including the general performance outcomes that are expected of the student  
attendance policies  
grading policies including information about quizzes, papers, and homework assignments, and how each will influence the final grade

It is **suggested** that the syllabus also includes the following:  
the general nature of the course  
an overview of the course organization  
format for extra assignments including research papers, student projects, and/or homework

It is **required** for the syllabus to include the following and it is important for the TA to cover these topics with the students:  
**Disabilities**: If a student has a disability that qualifies under the American with Disabilities Act (ADA) and requires accommodations, he/she should contact the Office
for Disability Accommodations (ODA) for information on appropriate policies and procedures. Disabilities covered by ADA may include learning, psychiatric, physical disabilities, or chronic health disorders. Students can contact ODA if they are not certain whether a medical condition/disability qualifies.

Address:
The University of Southern Mississippi
Office for Disability Accommodations
118 College Drive # 8586
Hattiesburg, MS 39406-0001
Voice Telephone: (601) 266-5024 or (228) 214-3232  Fax: (601) 266-6035

Individuals with hearing impairments can contact ODA using the Mississippi Relay Service at 1-800-582-2233 (TTY) or email Suzy Hebert at Suzanne.Hebert@usm.edu.

Statement on immunocompromised individuals: For labs in which a risk of contracting infections and/or diseases which could be serious or even fatal, it is important for students with immune system deficiencies to discuss their situation with the Lab Coordinator or Instructor of Record. These conditions include, but are not limited to, individuals undergoing chemotherapy, taking immuno-suppressive drugs such as corticosteroids, having diabetes, having autoimmune disease (such as lupus erythematosis or multiple sclerosis), being pregnant, and/or being HIV positive. A student who suspects that he/she has less than normal immune function should consult a physician as to the advisability of enrolling in any laboratory where there are chemicals and/or microorganisms that may present a health threat.

The last day to drop: (month/date) is the last day to drop without academic penalty. It is the policy of the College of Science and Technology that a student who is failing cannot receive a withdraw pass after the drop date. Forms will not be signed after the drop date for students who are failing the laboratory.

Statement on cheating/plagiarism: You are encouraged to work and study with your classmates, both in and out of lab. However, plagiarism of a fellow student or other source is expressly forbidden (see the Code of Student Conduct in your Student Handbook). The minimum academic penalty will be a grade of zero on the assignment or examination associated with the violation.

http://www.lib.usm.edu/research/plag/plagiarismtutorial.php

Other expectations for the TA on the first day of lab include:
Bring attention to the contact information of the TA, the lab manual and/or other required materials, and quiz/exam dates.

Explain the use of the web courseware (if any) and point out the web address.
Be sure to explain attendance procedures to students. Make it clear that labs begin on time. You will not wait for stragglers to arrive.

The roll should be called in every laboratory section.

Any students in attendance who do not appear on the laboratory roll for that section must be identified and their names must be given to the instructor of record. Students who do not attend lab can lose financial aid.

All students attending laboratory sections other than those for which they have registered, must have special permission from the lab coordinator prior to attending.

Laboratory space is limited in many labs and indiscriminate switching between sections is not allowed. This rule also applies to lab practicals. An exception may be allowed occasionally, at the discretion of the instructor of record.

Although laboratories vary in length, students are expected to remain in the laboratory for the full period. Students departing early should sign out with the teaching assistant. They should also be informed that their grade will be affected.

Make certain students understand the procedure to be followed when unavoidable circumstances cause them to miss a laboratory. Such students must consult with the laboratory coordinator about lab make-up at the earliest possible time.

Emphasize that laboratories are scheduled on a weekly basis, or even a daily basis and that it is therefore extremely important to make arrangements for attending another lab section during the same week or even on the same day. Students who do not make proper arrangements will receive a zero.

The issues of cheating and plagiarism should be discussed to minimize the possibility of misunderstandings. You should stress that cheating affects the honorable and conscientious students most. Therefore, it is in their best interest to make individual and collective efforts to see that the highest standards of honesty are upheld. Refer to the section on cheating and confrontation in this manual.

Discuss the grading policy and be very clear about the procedures that will be followed. After that, always be consistent and do not deviate from the initial policy that is stated in the syllabus.

Try to learn your students’ names as soon as possible. You may want to consider using a seating chart for the first week or two. If you give quizzes or written assignments, a good
way to check your memory is to pay attention to names and faces when you return papers in class.

LABORATORY GRADING POLICIES/ADD/ DROP PROCEDURES

Teaching assistants should discuss the grading and attendance policies with their students on the first day of the laboratory. These policies should be held to rigorously and should include statements on absences, make-ups (labs, exams or quizzes) and the grading scale.

Grading should be calculated promptly, fairly and consistently. Lab quizzes must never be graded with students present. This policy is important to insure accurate, non-partisan grading.

You should review the graded quizzes and papers with students the following week so that they are aware of their performance throughout the semester. Let students know that they should keep their papers as a record of their performance in your lab.

You must treat every student equally. Never put yourself in a position where you may be accused of favoritism to any one student or of showing undue partiality to any one group of students.

Midterm Grades
Midterm grades must be turned in to the Instructor of Record by the due date. This is eight weeks into the semester.

Turning in Grades at the End of Each Semester
At the end of each semester, TAs are required to submit undergraduate laboratory grades for each class to the instructor of record. The instructor of record, with the help of each TA, enters students’ grades using SOAR.

Add/Drop Procedures
TAs are responsible for checking student enrollment and reporting any inconsistencies in the roster to the instructor of record.

If a student needs to ADD or DROP the lab, or CHANGE SECTIONS, the Instructor of Record, the Chair of the Department [BSC (JST 720), CHE (TEC 430)] and the Dean of the College of Science and Technology (TEC 105) must sign the ADD/ DROP slip. ADD/ DROP slips are obtained by the undergraduate student from the registrar’s office.

LABORATORY PREPARATION

Weekly Prep Sessions
In most cases, teaching assistants are required to attend a prep session every week. You must be on time for this meeting with the laboratory coordinator. Remember, this is your job!

Attendance
Teaching assistants should be in the laboratory 30 minutes prior to their assigned lab (times may differ according to the lab). The lab coordinator or instructor of record should be consulted about any unforeseen events or special circumstances, which may have developed before the lab begins.

The TA is required to be present for the entire laboratory class period. Teaching assistants who are prevented from attending an assigned laboratory due to some emergency situation beyond their control (i.e., illness, conference, etc.), must inform the laboratory coordinator immediately, and secure a suitable substitute to teach their section of lab.

Organizing/Setting up the Lab
The teaching assistant should set up the laboratory material and/or equipment and must be sure all pieces of equipment are in working order. Any improperly functioning pieces of equipment should be appropriately labeled and brought to the attention of the preparatory person, laboratory coordinator or instructor of record. Be sure to seek permission from whoever is in charge before borrowing any equipment from another lab.

The TA should be prepared to teach his/her class by reviewing and developing class notes and/or other instructional materials prior to the beginning of lab.

Each section should be given a verbal statement of objectives for that laboratory period, as well as a verbal description of the activities involved. Special problems and safety precautions should be stressed; the location of materials and, equipment, which will be used in common by all the students, should be clearly identified.

At the end of each laboratory period all material should be reassembled, restocked, and/or cleaned in preparation for the next laboratory. Check carefully to make sure all models, manikins (in anatomy labs), microscopes or other pieces of equipment are accounted for.

The teaching assistant conducting the last laboratory period of the day should:
return all equipment (models, microscopes) to their appropriate storage locations
lock storage cabinets
check all material and equipment for breakage, and identify any expendable material which may require restocking.
turn off refrigeration units (where applicable)
be sure all gas jets are off
turn off lights
make certain the laboratory door is locked upon departure

Any problems thus discovered should be reported immediately to the laboratory coordinator or instructor of record. Laboratory classrooms should be clean and orderly when you leave.

DEPARTMENT OF BIOLOGICAL SCIENCES LABORATORY WEBSITE

Resources including syllabi, handouts and other resources for the Department of Biological Science teaching laboratories are available on the departmental website (www.usm.edu/biologylabs) for use by the students in the following labs: BSC 103L, 107L, 110L, 111L, 201L, 226L, 250L, 251L, 380L and 381L. This website is maintained by Mehdi Pirooznia (pirooznia@gmail.com) and is updated periodically. TAs who teach these labs should inform students of the availability of these web pages and encourage their use. Updated materials may be added to the website with approval of the laboratory coordinator or the instructor of record.

OTHER DEPARTMENTAL RESOURCES

Use of the Departmental Copy Machine
Copies of biology laboratory materials are made in JST 709. TAs should anticipate their copying needs in advance and deliver the material to be copied to Ms. Angela Williams with clearly written instructions (number of copies to be made, whether copies may be duplexed, how copies are to be stapled, date when copies are needed, etc.). Personal copies of documents may be made at $.05 a page.

Copies of chemistry laboratory materials should be given to Frank Woodruff.

Distilled water
Distilled water is available in the prep rooms of WSB 125, 150 and JST 504 as well as the 4th floor of the TEC building or check with laboratory coordinator or instructor of record for other water dispensers.

CHEATING AND STUDENT CONFRONTATION

Dishonesty is both a moral and administrative concern for any instructor. The policy of the University of Southern Mississippi is stated in the Handbook for Advisors and Teaching Faculty in the College of Science and Technology. It states “The minimum penalty for cheating or plagiarism is a failing grade in the assignment. Instructors may refer students to the Student Handbook, where the university’s policy is fully explained. Instructors are encouraged to document all evidence in suspected cases of academic
dishonesty before accusing a student. The University attorney is a good resource to consult if you have any questions about how to proceed in these cases.”

The TA should discuss the question of dishonesty with the laboratory coordinator or with the instructor of record at the beginning of the semester to be sure they agree on the procedure to follow should problems arise. This will assure that all students are treated fairly.

The Teaching Assistant should be sure that students understand the policies and procedures and some class time at the beginning of the semester should be set aside for questions and procedures regarding cheating.

**Plagiarism & Cheating on Tests/Quizzes**

Plagiarism is a common form of dishonesty that is often misunderstood by students. Plagiarism results when a student copies statements, ideas, or opinions from another source without acknowledgment from that source and submits this material as his/her own work.

**How Do Students Cheat?**
1. Students pass information to a neighbor. For example, they may loan a neighbor an eraser with the answer on the eraser.
2. Students use notes written on clothing (especially baseball caps), skin, or small note cards.
3. Students peek at a knowledgeable neighbor’s exam (sometimes seated in groups around the best student in the class).
4. Students use a tapping or hand code.
5. Students accuse the teacher of losing an exam (which was not turned in).
6. Students pay someone else to take an exam or write a paper for them.
7. Students write answers on their hands or legs.
8. Students text message during an exam/quiz.
9. Students copy or paraphrase material for a paper without acknowledging the source.

**Preventing Cheating**

Cheating may result when students feel frustrated and desperate or when they are simply given the opportunity. You can try to prevent cheating by:
1. Providing a number of opportunities for students to demonstrate achievement of course goals, rather than relying upon a single examination.
2. Devising examinations that provide fewer opportunities for cooperative student efforts (essay exams are less conducive to cheating.)
3. Make reasonable demands and write a reasonable and interesting quiz/exam.
4. Actively proctor the quiz/exam by being alert and watching for questions.
5. Before the quiz/exam, write on the board, “Take alternate seats” or stand at the door and mention this to students as they enter the room.
6. In a large class, if students cannot take alternate seats due to the size of the room, you may need to prepare two alternate forms of the quiz/exam, scrambling both the order of the items and the order of the answers.
   Always ask Angela in JST 709 to copy your tests for you. NEVER leave copies of the quizzes/exams lying around the lab or in your office.
   Always count the number of students taking the quiz/exam; count the number of quizzes/exams you have before and after administering it.

Confrontations about Cheating
You must be extremely careful about how you deal with dishonesty issues. It is almost inevitable that you will face this problem during your teaching career. For example, you are administering an exam and you notice a student’s eyes on a neighbor’s rather than his/her own paper. Typically, you do nothing at this point. If the behavior continues, you have several options to consider. You may move closer to the individual or stand behind the person. This usually works to stop the action. You might also announce to the class that you have seen someone cheating and the behavior must stop.

Keep in mind that you will need to document any incidence of cheating. This is difficult to do and often results in a situation where it is your word against the student’s.


SEXUAL HARASSMENT

Sexual harassment is difficult to contend with because the issue of power (the instructor’s power over the student’s) is at the base of this ethical problem. It is important to remember that instructors must respect students as individuals and must make learning the primary concern in all courses.

The following statements are found in the USM Undergraduate and Graduate Bulletins:
Policy Statement: “The University of Southern Mississippi in its efforts to foster an environment of respect for the dignity and worth of all members of the University community is committed to maintaining a work-learning environment free of sexual harassment. It is the policy of the University that no member of its community shall sexually harass another. Any employee or student who violates this policy is subject to disciplinary action. Sexual harassment is illegal under both state and federal law.”
Sexual Harassment Defined: “Unwelcomed sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitute sexual harassment when (1) submission to such conduct is made either explicitly or implicitly a term or condition of an individual’s employment or education (2) submission to, or rejection of, such conduct by an individual is used as the basis for academic or employment decisions affecting such individual; or (3) such conduct has the purpose or effect to substantially interfere with an individual’s academic or work performance or to create an intimidation, hostile, and offensive academic or working environment.

Under the law, there are two types of sexual harassment: quid pro quo harassment and environmental harassment.

**Quid Pro Quo**

Quid pro quo harassment or “this for that” harassment occurs when specific academic or employment benefits are withheld as a means of coercing sexual favors. The harasser uses his or her actual or apparent authority to make academic or employment decisions based on whether or not the victim complies with the harasser’s sexual advances, requests, or conduct.

Examples include, but are not limited to:
- Threat of punishment, such as a lower grade in a course, for refusal to comply with sexual advances
- Indicating that sexual favors could lead to better grades
- Extorting sexual favors from a student in exchange for academic benefits

**Environmental**

Environmental sexual harassment occurs when a faculty member or employer creates or permits an intimidating, hostile, or offensive atmosphere. Generally, incidents of sexual harassment must be repeated and pervasive to qualify as environmental harassment.

Examples (intimidating, hostile, or offensive educational or work environment) include, but are not limited to:
- Unwanted sexual attention or advances
- Sexual propositions
- Placing sexually explicit materials on display in the workplace or using such materials in class in a way that is not educational.

**DISRUPTIVE BEHAVIOR**

If one or more students behave in a disruptive manner you may try the following:
Stop the class. Do not continue until you feel that the situation is under control.
Ask the student if he/she has a question or problem.
Talk to the student individually, before or after class.

DISABILITY ISSUES

The University of Southern Mississippi provides reasonable accommodations for students with disabilities through the Office for Disability Accommodations (ODA). ODA verifies eligibility for accommodations and works with eligible students to develop and coordinate plans for the provision of accommodations. The Office of Support Services for Students with Disabilities is located on the first floor of Bond Hall.

Eligibility
Eligible students include those who are enrolled in degree and non-degree programs offered by USM, who are considered qualified to meet all University program requirements despite a disability, and who meet the definition of disability as defined by the Rehabilitation Act of 1973 and the Americans with Disabilities Act. The definition of disability includes any person who “...has a physical, emotional, or mental impairment which substantially limits one or more of life’s major activities; has a record of disability or is regarded as having a disability”. In determining if a student is “qualified” to meet all program requirements, the University must base its decision on the skills, interests, and aptitudes of a student and not on presumptions that would arbitrarily exclude a student from participation in a program or activity.

ODA Accommodations and Services
The faculty and staff of USM are receptive to the needs of students with disabilities across the academic and non-academic programs on campus. The Office for Disability Accommodations offers a number of accommodations and support services. These include, but are not limited to, the following:
Letters to instructors requesting accommodations, such as advanced notice of assignments, lecture notes, or use of tape recorders.
Information coordination and appropriate referrals.
Referral to other campus services (i.e., career center, counseling, speech and hearing services).
Liaison services between USM faculty/staff and student about disability needs.
Faculty/staff orientation and technical assistance on request.
Liaison services with rehabilitation agencies (i.e., funding, campus orientation, technology, accommodations, wheelchair repair).
Referrals for accessible housing.
Sign language interpreters, note takers, and readers.
Accessible classroom/location/furniture.
Assistive technology.
Document conversion (enlarged or taped text, film and video transcription).
Assistance in obtaining recordings for the blind and dyslexic.
Exam modifications (extended time, distraction-free environment, test proctors, readers, or scribes).
Alternative test formats (short answer, multiple choice, oral, etc.).
Study skills and strategies training.
Resource center for disability information and publications.

Accommodations are designed to meet the individual needs of each student and are therefore planned and implemented in conjunction with the student. The University may refuse an unreasonable accommodation, adjustment and/or auxiliary aid, or service that imposes a fundamental alteration on a program or activity of the University.

SAFETY AWARENESS
TAs must be able to demonstrate their ability to explain and practice safe laboratory procedures consistent with the activities and exercises associated with their respective assignments. It is important for the TA to discuss safety regulations for the lab with the students on the first day of lab.

The following items must be considered when determining safety regulations:
Distribution of Safety regulations and Safety Awareness Agreement to be read and signed by each laboratory student on the first day of class.
The TA should be instructed in the proper use of an autoclave.
The TA should be instructed in the methods for handling:
   a. biological spills
   b. chemical spills
   c. broken glassware
   d. using universal precautions with blood and other body fluids
TA in labs using microorganisms should be instructed in the methods for:
   e. aseptic transfer of microbes
   f. prevention of aerosols
   g. proper hand washing
   h. disinfecting lab benches prior to and at the conclusion of each lab session
   i. identification and proper disposal of different types of waste
   j. identification of the Biosafety level of each organism in the laboratory
Students should never be allowed to:
   k. eat or drink in the laboratory
   l. use tobacco products (including chewing tobacco) in the laboratory
   m. apply cosmetics
   n. handle contact lenses
   o. place objects (fingers, pencils, etc.) in the mouth
TAs are responsible for:
   p. responding to all spills immediately
q. reporting all injuries immediately
r. completing the appropriate accident reports

The TA should be sure all students know:
s. the importance of wearing protective equipment (goggles, coats, gloves) and use in appropriate situations
t. correct methods for using appropriate pipetting devices
u. location and proper use of emergency equipment (first aid kit, eye wash stations, fire extinguishers, chemical safety showers, glass disposal, telephones and emergency numbers)
v. proper steps in the event of an emergency
w. shoes must be worn at all times

In addition, the Department of Biological Sciences will:
x. provide and maintain all necessary safety equipment and information resources
y. train TAs in the use of safety equipment.

Injuries
If a student is injured in the laboratory, an accident report form must be completed and signed by the TA, the instructor of record, the laboratory coordinator, and the Chair of the Department. A copy of this form may be found at the back of this manual.

As a precautionary measure never touch blood (wet or dry) without using latex gloves. Do not administer any medications. Always refer the student to the USM health clinic. The Campus Police (911) may also be called if there is a medical emergency.

Use of Autoclaves/Dishwasher and Autoclave
A new autoclave is located in Walker Science Building (WSB 150/138 prep room). TAs must be instructed as to the proper operation of the autoclave/dishwasher prior to their use.
The autoclave logs must be signed prior to each use.

Regulations and Forms
The Department of Biological Sciences requires teaching assistants to obtain a signed safety agreement statement from each student. Hand out a copy of the Safety Regulations and Safety Agreement forms to each student and read the regulations to the class. Each student must sign a form. Collect the forms and return them to the lab coordinator or instructor of record. Examples of these regulations and forms are included in this booklet.
ADDITIONAL TEACHING RESOURCES


APPENDIX

General Laboratory Safety Regulations 19
Safety Regulations for the Microbiology Laboratory 20
Safety Awareness Agreement 22
Accident Report Form 23
Extra Paper for Note Taking 24
GENERAL LABORATORY SAFETY REGULATIONS

ALWAYS:
Keep lab doors closed and locked when not in use.
Know two ways out of the building and the location of the nearest fire extinguisher.
Know the location of the nearest emergency eye-wash station.
Wear the appropriate personal protective equipment: lab coat, close toed shoes, safety glasses, gloves.
In case of a chemical spill, evacuate the lab and call Safety Officers, Frank Woodruff or Lynn Landrum (601.266.6912).
Consult the Material Safety Data Sheet (MSDS) before working with an unfamiliar chemical. Lynn Landrum, the Biosafety Officer can supply this information to you.
Keep flammable liquids stored in a flammable storage cabinet, NOT UNDER A HOOD.
Use an appropriate container for the disposal of syringes and broken glass.
Label chemical waste with chemical name, solution concentration, date generated, and your name.
Use the appropriate container for glass disposal (the “broken glass disposal box”).
Inspect equipment before using it and report all defective equipment and unsafe conditions to the lab coordinator or the instructor of record.

NEVER:
Work in the lab alone.
Consume food or drink in the lab.
Store chemicals under a hood.
Block access to the electrical panels.
Use equipment with spliced or frayed wires.
Block aisles or exits with equipment or storage.

PERSONS TO CONSULT FOR FURTHER INFORMATION:
Your lab instructor of record or major professor.
Assistant Director of Science Safety, Lynn Landrum 601.266.6912
Campus Safety Inspector, Kristi Marsh 601.266.4490
Police Emergency 911
Police Non-emergency 601.266.4986
Clinic 601.266.5390
SAFETY REGULATIONS FOR THE MICROBIOLOGY LABORATORY

The rules listed below are designed to protect you and others who are in the microbiology laboratory. You are working with live microorganisms, most of which are harmless, but others, if ingested, may cause physical discomfort. Keep in mind that these organisms are in pure culture and are therefore present in large numbers. What tends to be a rather innocuous organism in our everyday environment may prove to be dangerous when grown in great numbers. In addition, we cannot determine your susceptibility to these organisms, so care must be taken to avoid exposure. You can easily protect yourself and others by following these simple instructions.

Wash your hands before you begin the laboratory exercise and before you leave.
Disinfect your work area before you begin and after you complete the laboratory.
Keep your workspace neat, clean and uncluttered throughout each laboratory period.
Store clothing and books not being used in your bottom drawer to eliminate the possibility of contaminating personal belongings.
Do not smoke, drink, or eat in the laboratory.
Pencils, labels, or any other materials should never be placed in your mouth.
Always wear shoes and a lab coat or apron at all times.
Be careful of loose clothing and long hair. Keep your hair tied back out of your way.
Be constantly aware of the placement of your Bunsen burner and have it on only when you are using it.
Never discard microorganisms or contaminated materials into wastepaper baskets or into sinks. (a) Place contaminated pipettes, slides, applicator sticks, or cotton swabs into the designated trays that contain disinfectant. (B) Place used culture tubes and plates in a designated place as you are instructed.
Do not throw broken glass into wastepaper baskets.
Do not stack Petri dishes more than three high on incubator shelves, unless you use the metal holders. Stacks without holders are a hazard if they should topple over in the incubator or onto a table.
If you spill or break something, report it immediately to your instructor. Spilled microorganisms should be covered with paper towels and saturated with disinfectant. The disinfectant should be allowed to soak the area for at least 15 minutes before cleanup. The contaminated area should subsequently be disinfected.
Do not mouth pipette any organism or open any Petri dish to smell the culture. Notify your instructor if you cut or burn yourself or if you contaminate any part of your body (mouth, eyes, or skin) with a culture.
Be careful when using a pipette bulb. Gently insert the glass pipette into the bulb. Severe cuts may result if you force the glass pipette into the bulb. It may slip and gash your hand.
Never remove anything from the laboratory without permission.
Inoculated media placed in the incubator must be properly labeled, i.e. with your name, date, and the details of your experiment and put on the assigned shelf.
When flaming your inoculating loop, always place the loop near the base of the flame to incinerate any organisms. This is particularly important if you have a clump of bacteria on your loop. You want to minimize any aerosols from dispersing into the air.

Fire extinguishers are located in the following areas in the lab in WSB 138:
   Room 138a - in the prep room
   Room 138 - over the sink

Safety showers and eye wash stations are located in the prep room in WSB 138a.

Emergency Telephone Numbers:
   Ambulance                     911
   Poison Control Center        601.288-4445
   Campus Police                911
   Physical Plant               601.266.4414
SAFETY AWARENESS AGREEMENT

Department of Biological Sciences
University of Southern Mississippi

By signing this I hereby certify that I have read and understand the safety guidelines in the laboratory portion of this syllabus. I understand that it is required that I abide by the safety guidelines in this laboratory. I will keep a copy of this laboratory syllabus in my possession as long as I am enrolled in this laboratory. I acknowledge that I have been instructed as to the proper procedures and safety regulations in this laboratory.

I will notify the laboratory instructor of any accident as soon as possible. I understand that any failure to follow the safety rules may result in my immediate dismissal from the laboratory.

____________________________________
Student’s Name (Printed)

____________________________________  ____________________
Student’s Signature       Date

____________________________________  ____________________
Laboratory T.A.’s Signature     Date

Laboratory Number and Section  BSC-

This sheet must be presented to your laboratory instructor during the first laboratory class meeting. If you have any questions concerning this statement, please contact the Laboratory Coordinator or Instructor of Record.

This form will be kept on file in the Biological Sciences Office.
ACCIDENT REPORT

TO: Chair, Department of Biological Sciences

THROUGH: Faculty Member in Charge of Laboratory

Name of Injured

Date: ___________ Time: ________(a.m.) (p.m.) Location: ___________

Teaching Assistant (if applicable):

Witnesses to incident (if any):

Nature and extent of injury:

Action taken (type of first aid, transported to clinic, etc.):

Cause and action taken to prevent reoccurrence:

Signature of Injured Individual:

Signature of Teaching Assistant:

(if injury occurred in, or in conjunction with, teaching laboratory)
APPENDIX B

BSC 600 SYLLABUS AND SEMINAR AGENDAS

Professional Development for Graduate Teaching Assistants

Instructor: Aimée T. Lee
Office: MHB 005B
Phone: 266-6374
E-mail: aimee.lee@usm.edu

Overview of course:
This course is a seminar designed to prepare graduate students to teach laboratories in the biological sciences. The seminar will include instruction and practice teaching in the biological sciences laboratory courses. We will also assess the impact of the course on teaching assistants’ method of instruction, preparation for teaching, and attitudes toward science teaching.

Course responsibilities:
1. Students will attend the workshop and subsequent seminar sessions and will complete assignments associated with their readings.
2. Students will be required to actively participate in group discussions on various topics.
3. Students will be required to collaborate and complete projects with other students.

Grading:
A grade of pass/fail will be assigned for this course.

Attendance:
Attendance is mandatory at all seminar gatherings. The course will meet five times throughout the semester including an eight-hour workshop followed by four, two-hour meetings.

Students with disabilities:
If a student has a disability that qualifies under the American with Disabilities Act (ADA) and requires accommodations, he/she should contact the Office for Disability Accommodations (ODA) for information on appropriate policies and procedures. Disabilities covered by ADA may include learning, psychiatric, physical disabilities, or chronic health disorders. Students can contact ODA if they are not certain whether a medical condition/disability qualifies. Address:
The University of Southern Mississippi
Office for Disability Accommodations
118 College Drive # 8586
Hattiesburg, MS 39406-0001
Voice Telephone: (601) 266-5024 or (228) 214-3232 Fax: (601) 266-6035
Individuals with hearing impairments can contact ODA using the Mississippi Relay Service at 1-800-582-2233 (TTY) or email Suzy Hebert at Suzanne.Hebert@usm.edu.
<table>
<thead>
<tr>
<th>Class</th>
<th>Topics</th>
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<tbody>
<tr>
<td>Workshop</td>
<td>Introduction to the course</td>
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<td>Expectations for Laboratory Teaching Assistants</td>
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<td>Guidelines for Effective Teaching</td>
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<td>The First Day of Class in a Biology Laboratory</td>
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<td>Classroom Management: cheating, plagiarism, sexual harassment, student</td>
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<td>confrontation &amp; disruptive behavior</td>
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<td></td>
<td>Guest Speakers: Disability Issues, Equal Opportunity, Police, and Student</td>
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<td>Health</td>
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<td>Safety in the Laboratory Demonstration: Fire safety</td>
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<td>Departmental and University Resources</td>
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<td>Teaching College Science Laboratory Courses: investigative, interactive,</td>
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<td></td>
<td>&amp; constructivist perspectives methods of teaching science laboratories</td>
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<td>How People Learn: The Science of Teaching Science and Characteristics</td>
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<td>of Learners</td>
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<td>Motivating Students to Learn How to Think</td>
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<td>Assessing Learning in Science Laboratory Courses</td>
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<td></td>
<td>Best Practice Panel Discussion led by Experienced Teaching Assistants</td>
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</tbody>
</table>

| Meeting 1 | Pre-test: Attitudes toward science                                     |
|           | Planning to teach college biology laboratories                          |
|           | Project – Applying methods of teaching by classifying labs in manual   |
|           | Activity – Learning how to teach using inquiry techniques              |

| Meeting 2 | Understanding the dimensions of biological literacy                   |
|           | Evaluation and Grading: The ABC’s of assigning grades                 |
|           | Assessment of student learning                                        |
|           | Bloom’s taxonomy of the cognitive domain                               |

| Meeting 3 | Assessment of student learning                                        |
|           | Bloom’s taxonomy of the cognitive domain                               |
|           | Activity - Writing good quiz and test questions                        |
|           | Developing rubrics to assess performance                               |

| Meeting 4 | Individual presentations                                              |
|           | Post-test: Attitudes toward science                                   |
|           | Administer evaluation of the course                                   |
BSC 600 Professional Development for Graduate Teaching Assistants

Meeting 1-10:00 AM to 11:50 AM

SEMINAR AGENDA

10:00 Ice Breaker
10:10 What is your attitude toward science?
10:30 Planning to Teach College Biology Laboratories
11:00 Break
11:10 Activity: Fossil Footprint Puzzle
Post activity discussion
11:30 Activity: Classify the laboratory exercises in the manual for the lab course you are teaching into guided inquiry, open-ended inquiry, and traditional (cookbook).
11:50 Adjourn

Handouts:
Creating a Classroom Culture that Inspires Student Learning
The laboratory is an important component of science instruction.
The 5E Instructional Model: What the Teacher Does, What the Students Do
Are You as Good a Teacher as You Think?
Mistaken Assumptions That Mislead Beginning Teachers
Description of the project due next seminar

Next time:
Bring 5 quizzes that you have written for your labs this semester.

BSC 600 Professional Development for Graduate Teaching Assistants

Meeting 2-10:00 AM to 11:50 AM

SEMINAR AGENDA

10:00 Engage activity
10:10 Understanding the Dimensions of Scientific Literacy
10:30 Assessment of Student Learning
11:00 Break
11:10 Bloom’s Taxonomy of the Cognitive Domain
Activity: Writing good quiz and test questions
11:50 Adjourn
BSC 600 Professional Development for Graduate Teaching Assistants

Meeting 3 - 10:00 AM to 11:50 AM

SEMINAR AGENDA

10:00   Ice Breaker
10:10   ABC’s of Assigning Grades
10:30   Assessment of Student Learning - Rubrics
11:00   Break
11:15   Rubric activity
11:50   Adjourn

Handout:
Sample rubrics

Discuss Project:
Choose a concept (e.g. DNA, Digestive System, etc.). There may be 1 or 2 or more exercises to teach the concept. Construct an assessment, which may be a holistic rubric, an analytical rubric, general or task-specific. You may prepare more than one rubric to evaluate students’ learning of the concept.

Be prepared to present your project during the last seminar meeting.

BSC 600 Professional Development for Graduate Teaching Assistants

Meeting 4 - 10:00 AM to 11:50 AM

SEMINAR AGENDA

10:00   Individual presentations on assignment: Creating a rubric to assess a laboratory assignment
11:00   Post-test: What is your attitude toward science?
        BSC 600 Course Evaluation
11:50   Adjourn
APPENDIX C

LECTURES DEVELOPED FOR BSC 600

Lecture 1 - Planning to Teach College Science Laboratories
Lecture 2 – Understanding the Dimensions of Scientific Literacy
Lecture 3 – Assessment of Student Learning
Lecture 4 – ABC’s of Assigning Grades
Lecture 5 – How People Learn
APPENDIX D

TEACHING GOALS INVENTORY

ID
Please write the 1st letter of your last name and last 4 digits of SS#

Directions: Please select ONE course you are currently teaching. Respond to each item on the inventory in relation to that particular course. (Your responses might be quite different if you were asked about your overall teaching and learning goals, for example, or the appropriate instructional goals for your discipline.)

Please print the title of the course you are focusing on:

Please rate the importance of each of the fifty-two goals listed below to the specific course you have selected. Assess each goal's importance to what you deliberately aim to have your students accomplish, rather than the goal's general worthiness or overall importance to your institution's mission. There are no "right" or "wrong" answers; only personally more or less accurate ones.

For each goal, circle only one response on the 1-to-5 rating scale. You may want to read quickly through all fifty-two goals before rating their relative importance.

In relation to the course you are focusing on, indicate whether each goal you rate is:
(1) Not applicable a goal you never try to achieve
(2) Unimportant a goal you rarely try to achieve
(3) Important a goal you sometimes try to achieve
(4) Very important a goal you often try to achieve
(5) Essential a goal you always/nearly always try to achieve

<table>
<thead>
<tr>
<th>ID</th>
<th>1. Develop ability to apply principles and generalizations already learned to new problems and situations</th>
<th>1 2 3 4 5</th>
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<tr>
<td></td>
<td>2. Develop analytic skills</td>
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<td>3. Develop problem-solving skills</td>
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<td>4. Develop ability to draw reasonable inferences from observations</td>
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<td>5. Develop ability to synthesize and integrate information and ideas</td>
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<td>6. Develop ability to think holistically: to see the whole as well as the parts</td>
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<td>7. Develop ability to think creatively</td>
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<td></td>
<td>8. Develop ability to distinguish between fact and opinion</td>
<td>1 2 3 4 5</td>
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<td></td>
<td>9. Improve skill at paying attention</td>
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<td></td>
<td>10. Develop ability to concentrate</td>
<td>1 2 3 4 5</td>
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<td></td>
<td>11. Improve memory skills</td>
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<td></td>
<td>12. Improve listening skills</td>
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<td>13. Improve speaking skills</td>
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<td>14. Improve reading skills</td>
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<td>15. Improve writing skills</td>
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<td></td>
<td>16. Develop appropriate study skills, strategies, and habits</td>
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<td>17. Improve mathematical skills</td>
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<tr>
<td>18. Learn terms and facts of this subject</td>
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<td>2</td>
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<td>19. Learn concepts and theories in this subject</td>
<td>1</td>
<td>2</td>
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<tr>
<td>20. Develop skill in using materials, tools, and/or technology central to this subject</td>
<td>1</td>
<td>2</td>
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<tr>
<td>21. Learn to understand perspectives and values of this subject</td>
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<td>22. Prepare for transfer or graduate study</td>
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<td>2</td>
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<tr>
<td>23. Learn techniques and methods used to gain new knowledge in this subject</td>
<td>1</td>
<td>2</td>
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<tr>
<td>24. Learn to evaluate methods and materials in this subject</td>
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<td>2</td>
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<tr>
<td>25. Learn to appreciate important contributions to this subject</td>
<td>1</td>
<td>2</td>
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<tr>
<td>26. Develop an appreciation of the liberal arts and sciences</td>
<td>1</td>
<td>2</td>
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<td>27. Develop an openness to new ideas</td>
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<td>2</td>
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<tr>
<td>28. Develop an informed concern about contemporary social issues</td>
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<td>2</td>
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<tr>
<td>29. Develop a commitment to exercise the rights and responsibilities of citizenship</td>
<td>1</td>
<td>2</td>
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<tr>
<td>30. Develop a lifelong love of learning</td>
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<td>2</td>
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<td>31. Develop aesthetic appreciations</td>
<td>1</td>
<td>2</td>
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<tr>
<td>32. Develop an informed historical perspective</td>
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<td>2</td>
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<tr>
<td>33. Develop an informed understanding of the role of science and technology</td>
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<td>2</td>
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<tr>
<td>34. Develop an informed appreciation of other cultures</td>
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<td>2</td>
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<tr>
<td>35. Develop capacity to make informed ethical choices</td>
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<td>36. Develop ability to work productively with others</td>
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<td>37. Develop management skills</td>
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<td>2</td>
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<td>38. Develop leadership skills</td>
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<td>39. Develop a commitment to accurate work</td>
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<td>2</td>
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<tr>
<td>40. Improve ability to follow directions, instructions, and plans</td>
<td>1</td>
<td>2</td>
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<tr>
<td>41. Improve ability to organize and use time effectively</td>
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<td>42. Develop a commitment to personal achievement</td>
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<td>43. Develop ability to perform skillfully</td>
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<tr>
<td>44. Cultivate a sense of responsibility for one’s own behavior</td>
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<td>45. Improve self-esteem/self-confidence</td>
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<td>46. Develop a commitment to one’s own values</td>
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<td>47. Develop respect for others</td>
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<td>2</td>
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<td>48. Cultivate emotional health and well-being</td>
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<td>49. Cultivate an active commitment to honesty</td>
<td>1</td>
<td>2</td>
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<tr>
<td>50. Develop capacity to think for one’s self</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>51. Develop capacity to make wise decisions</td>
<td>1</td>
<td>2</td>
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<tr>
<td>52. In general, how do you see your primary role as a teacher? (Although more than one statement may apply, please circle only one.)</td>
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<tr>
<td>a. Teaching students facts and principles of the subject matter</td>
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<tr>
<td>b. Providing a role model for students</td>
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<tr>
<td>c. Helping students develop higher-order thinking skills</td>
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<tr>
<td>d. Preparing students for jobs/careers</td>
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<tr>
<td>e. Fostering student development and personal growth</td>
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<tr>
<td>f. Helping students develop basic learning skills</td>
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</table>

Source: Classroom Assessment Techniques, by Thomas A. Angelo and K. Patricia Cross. 1993. Permission to reproduce is hereby granted.
# Perceived Level of Competence and Need for Support Questionnaire

**Perceived level of competence and need for support**

For each of the topics listed, please indicate your perceived level of competence using the following scale:

1 = not very competent to 5 = very competent

<table>
<thead>
<tr>
<th>Teacher preparation</th>
<th>Level of Competence</th>
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<tbody>
<tr>
<td>Teaching methods</td>
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Perceived level of competence and need for support
For each of the topics listed, please indicate your need for support using the following scale:
1=low or little need to 5=high or great need

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APPENDIX F

PARTICIPANT DEMOGRAPHIC AND BACKGROUND QUESTIONNAIRE

ID___________________________________
Please write the 1st letter of your last name and last 4 digits of SS#

Please check the appropriate answer for each of the following:

Demographics
  1. Gender
     □ Female       □ Male
  2. Ethnicity
     □ African American  □ Caucasian  □ Asian  □ Latino  □ Other __________
  3. Education completed
     □ B.S.    □ Master’s Degree   □ Other __________
  4. In what department are you getting your degree?
     □ Biology   □ Chemistry/Biochemistry  □ Physics  □ Mathematics  □ Other ______
  5. How many semesters have you been a graduate student? ________________

Teaching Experience
  6. Have you taught a lecture course at USM? □ Yes □ No
     If yes, list the lecture course(s) taught and the number of semesters you have taught that course.

     Lecture Course | Number of Semesters
     ______________________________________________________ | _______________
     ______________________________________________________ | _______________

  7. Have you guest lectured for a professor at USM? □ Yes □ No
     If yes, list the course(s) you guest lectured in and the number of times you guest lectured that course.

     Lecture Course | Number of Times
     ______________________________________________________ | _____________
     ______________________________________________________ | _____________
8. Have you taught a laboratory course at USM?  □ Yes  □ No

If yes, list the lab course(s) taught and the number of semesters you have taught each course.

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9. Have you led a discussion group for a course at USM?  □ Yes  □ No

If yes, list the course(s) for which you led the discussion session(s).

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10. Have you had any other teaching experience?  □ Yes  □ No

If yes, please explain.

Teaching Education and Preparation

11. Have you had any training to teach?  □ Yes  □ No

If yes, check all that apply:

□ Departmental training/workshop  □ College training/workshop
□ Campus-wide training/workshop  □ Formal coursework

12. Have you had any teacher education courses (i.e., course(s) dedicated to teaching theory, techniques or any pedagogical training)?

□ none  □ 1 – 3 credit hours  □ 4 -6 credit hours  □ ≥7 credit hours
13. How many hours per week do you typically spend preparing to teach (i.e., prior to entering the classroom)?
   ☐ < 1  ☐ 1 – 2  ☐ 3 – 4  ☐ 5- 6  ☐ > 6

14. How many hours per week do you typically spend teaching in the classroom?
   ☐ < 1  ☐ 1 – 2  ☐ 3 – 4  ☐ 5- 6  ☐ > 6

15. Are you supervised during the semester(s) you are teaching?  ☐ Yes  ☐ No
   If yes, check all that apply and circle the frequency:
   ☐ Individual meeting with a supervisor   a) once a week   b) once a month   c) once a semester
   ☐ Group meeting with a supervisor       a) once a week   b) once a month   c) once a semester
   ☐ Group meeting with peers              a) once a week   b) once a month   c) once a semester
   ☐ Other, please explain:

Future Teaching Plans

16. Do you plan to teach when you graduate?  ☐ Yes  ☐ No
   If yes, in what capacity?  ☐ K-12  ☐ Community College  ☐ University  ☐ Other

17. I will teach in some capacity when I finish my degree at Southern Miss?
   ☐ Strongly agree  ☐ Agree  ☐ Undecided  ☐ Disagree  ☐ Strongly disagree

18. I will teach science when I finish my degree at Southern Miss?
   ☐ Strongly agree  ☐ Agree  ☐ Undecided  ☐ Disagree  ☐ Strongly disagree

19. I will teach biology when I finish my degree at Southern Miss?
   ☐ Strongly agree  ☐ Agree  ☐ Undecided  ☐ Disagree  ☐ Strongly disagree
APPENDIX G

QUALITATIVE REFLECTION QUESTIONS

Professional Development in College Science Teaching Name:

Qualitative Research Data Collection 1

As you prepare to teach your first class of the semester tomorrow, please reflect and respond to the following questions in the space provided:

1. What are your teaching goals for the semester?
2. What concerns do you have about teaching [this course] this semester?
3. How confident are you in the content that you will teach tomorrow?
4. Describe what you did to prepare for teaching lab tomorrow.

Qualitative Research Data Collection 2

Now that you have taught your first lab of the semester, please reflect on your teaching by answering the following questions:

1. Do you think you will be able to accomplish your teaching goals for the semester? Explain.
2. Do you think you have the knowledge and skills necessary to effectively teach your course? Explain.
3. What type of support do you perceive you will need [if any] to effectively teach this course?
4. Were you well prepared to teach your course today? Explain.
Now that you have reached the midterm of the semester, please reflect and respond to the following questions:

1. What are your teaching goals for the semester? Have they changed since the beginning of the semester?

2. What concerns do you have about teaching [this course] this semester? Have they changed since the beginning of the semester?

3. How confident are you in the content that you have taught this semester and will teach the rest of the semester?

4. Describe how your preparation for teaching lab has changed since the first lab of the semester. If it hasn’t changed, speculate what you could do to be better prepared.

5. Have you received the support you have needed this semester to effectively teach the course?
APPENDIX H

THE USE OF HUMAN SUBJECTS IN RESEARCH (INSTITUTIONAL REVIEW BOARD)

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Institutional Review Board

118 College Drive #5147
Hattiesburg, MS 39406-0001
Tel: 601.266.6820
Fax: 601.266.5509
www.usm.edu/irb

HUMAN SUBJECTS PROTECTION REVIEW COMMITTEE
NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Event Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 20031103
PROJECT TITLE: Professional Development in College Science Teaching
PROPOSED PROJECT DATES: 09/11/09 to 06/10/10
PROJECT TYPE: Dissertation or Thesis
PRINCIPAL INVESTIGATORS: Almoe T. Leo
COLLEGE/DIVISION: College of Science & Technology
DEPARTMENT: Biological Sciences
FUNDING AGENCY: N/A
HSPRC COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 08/11/09 to 08/10/10

[Signature]
Lawrence A. Hosman, Ph.D.
HSPRC Chair

[Signature]
Date
APPENDIX I

FREQUENCIES OF PERCEIVED LEVEL OF COMPETENCE AND NEED FOR SUPPORT IN TEACHER PREPARATION AND PROFESSIONAL DEVELOPMENT

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