ENVIRONMENTS THAT ENCOURAGE MATHEMATICS GRADUATE

TEACHING ASSISTANTS: THE EFFECTS OF INSTITUTION

TYPE AND AVAILABILITY OF TRAINING

by

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ABSTRACT

This dissertation examined factors which are related to mathematics graduate teaching assistants' (GTAs') teaching attitudes and perceptions of the support for good teaching in their respective math departments. The research questions addressed differences between math GTAs at four groups of universities, categorized using an institution's Carnegie Classification and the availability of teacher-training for GTAs, in regard to math GTA perceptions of the support for good teaching in their department and in regard to math GTA attitudes toward teaching. Additionally, correlations between math GTA perceptions for support and math GTA attitudes toward teaching were examined. Finally, through use of multiple data sources, a qualitative analysis of the primary teaching support structures available to math GTAs at the participating universities in the four groups was conducted. The majority of data were collected through the Teaching Assistant Survey which was distributed in Fall 2005. Participants were 252 math GTAs representing 13 Research Universities – Extensive (R/E), and 16 Research Universities – Intensive (R/I).

A brief synopsis of the study results is as follows: Math GTAs at R/I Universities perceived more support for good teaching in their departments than math GTAs at R/E Universities. Math GTAs at R/I Universities reported more positive attitudes toward teaching than their counterparts at R/E Universities. There existed a weak positive correlation between perceived departmental support for good teaching and GTA attitudes toward teaching. The effects of training on GTA attitudes toward teaching and perceptions of support for good teaching were inconsistent. The qualitative analysis of a particular open-ended survey item about support for good teaching suggests that the construct of departmental culture and the ways in which a department can support good teaching are far more complex than anticipated.

CHAPTER 1

STATEMENT OF THE PROBLEM

<u>Introduction</u>

Graduate teaching assistants (GTAs) handle a significant amount of instructional responsibility at most universities in the United States. Teaching assistantships were initially established as a means to meet the financial needs associated with attending graduate school, but as larger numbers of students began working towards baccalaureate degrees, use of GTAs to expand teaching staff became a necessity at many institutions. Although instructional responsibilities vary by department and university, and can range from grading exams and conducting homework sessions to managing laboratories and selecting texts, it is common for GTAs to teach one or more sections of a department's general education level or basic course. Basic courses are a critical component of undergraduate education and produce a large portion of credit hours—and therefore funding—for many departments. Due to the major role GTAs play, "quality education for undergraduate students is strongly linked to the instruction provided by Graduate Teaching Assistants" (Commander, Hart & Singer, 2000, p. 93).

Although duties as a teaching assistant provide an income for many graduate students, most have entered graduate school with the primary goal of earning a post-baccalaureate degree. Even for the considerable number of GTAs who plan to work at a college or university upon graduation, honing teaching skills is typically a mere consequence of earning a graduate degree. GTAs assume a dual role as student and

teacher, and begin the struggle of balancing teaching and other scholarly responsibilities that may last throughout their careers. Faculty members, and likewise GTAs, want to participate in what is important and quickly recognize what is valued or rewarded at their institution (e.g., Talkakar, Micceri, & Eison, 1993). At many universities and in many departments a comparative emphasis is placed on research over teaching and service (e.g., Buerkel-Rothfuss & Gray, 1989), despite the fact that a large number of university missions include a statement regarding a commitment to excellence in teaching (Boyer, 1990). As Boyer (1990) and Eble (1983) assert, the perspective of what is deemed scholarship needs to be enlarged and redefined to avoid the idea that good teaching and research must remain mutually exclusive. Campus cultures and institution-wide support patterns need to emphasize the importance of effective teaching practice by all instructors.

Some estimates project a half million new professors will be needed by the year 2014 (Baiocco & DeWaters as cited in McGivney-Burelle, DeFranco, Vinsonhaler & Santucci, 2001), increasing the likelihood that GTAs will maintain their status as a key feature in colleges and universities beyond their graduate studies. "Although not all TAs are going to be professors, virtually all professors were once TAs" (Nyquist, Abbott, & Wulff, 1989, p. 9), suggesting that any efforts to improve the quality of teaching provided by GTAs may have the long term benefits of improving undergraduate education in general and establishing a commitment to professional development in the next generation of faculty (Barrington, 2001; Graff, 1994). Because of GTAs' identifiable role in undergraduate education and their potential role as future faculty members, it is

important to gain a clear understanding of factors related to their teaching abilities and teaching effectiveness.

Throughout the literature (Barrington, 2001; Borkowski, 2001; Dick, 1985; Halpern, 1994) it is noted that universities across the country place a relative emphasis on research over teaching. According to the Carnegie Foundation for the Advancement of Teaching (2001) there is a "close relationship between doctoral training and the conduct of academic research" (online, no page available). In *Scholarship Reconsidered* (1990), Boyer details the results of a national survey of faculty, where responses from over 5,000 faculty members are reported according to the 1987 Carnegie Classification categories. Regarding faculty surveyed at Research Institutes (comparable to the 2000 Research Extensive category), 66% identified their interests as lying primarily in research, and 33% indicated that their interests lie primarily with teaching. In sharp contrast to this, faculty surveyed at Doctoral Institutes (comparable to the 2000 Research Intensive category), 45% identified their interests as lying primarily in research, and 55% indicated that their interests lie primarily with teaching. The researcher anticipated that these differences in faculty attitudes and university missions would be reflected in math GTA perceptions of support and in math GTA attitudes towards teaching.

In addition to research on GTA training indicating its positive impacts on GTA teaching effectiveness and attitudes toward teaching (Lumsden, 1989; McGivney-Burelle et al., 2001; Moore, 1996; Talkakar et al., 1993; Smith, 2001), Boyer (1990) and Eble (1976) urge graduate schools to provide a seminar on teaching to students planning to teach or actually teaching. A seminar on teaching, or pedagogical training for GTAs, is a

way for graduate schools to give priority to teaching and to prepare new professors for their specialized work. It is one way for an institution to show support for and interest in teaching.

Literature on faculty and GTAs indicates that not only do faculty choose to participate in what is valued by the university, but that if an institution cares about teaching, faculty will give time to teaching (Blackburn, 1993; Diamond & Gray, 1987; Graff, 1994; Grunwald & Peterson, 2003; McGivney-Burelle et al., 2001; Smith, 1993). In particular, Eble (1976) notes that what affects teachers most when they start out is the "visible and invisible hand of the institution which employs them" (p. 62). Boyer (1990) closes *Scholarship Reconsidered* with a chapter about the success of the changing emphasis in scholarship relying on a "*shared* vision of intellectual and social possibilities" (p. 80, emphasis in original), created and fostered by anyone who is a stakeholder in a university's product and existence. It is this idea of a shared influence, as well as Eble's assertion that attitudes towards teaching shaped in graduate school are as important as subject matter learned and skills acquired, which encouraged the researcher to investigate links between institutional culture and GTA attitudes and their perceptions of departmental support for teaching.

As an example of the importance of graduate students in providing quality undergraduate education at a university, the researcher's home institution is a small land-grant college in the Northern Rockies, and for the 2005 fiscal year approximately ten percent of undergraduate student credit hours were taught by graduate teaching assistants across campus (B. Sharp, personal communication, September 14, 2006). For the Fall

2006 semester the mathematics department offered 104 lower division mathematics, mathematics education, and statistics courses. Of these 104 courses, sixty-four sections (61.5%) had a graduate teaching assistant as their primary instructor. Recognizing the significant involvement of graduate teaching assistants at universities across the country, this study contributes to the understanding of graduate teaching assistants in general by investigating mathematics graduate teaching assistants specifically.

Statement of the Problem

There is a lack of extant literature which investigates relationships among institutional culture and mathematics graduate teaching assistants' attitudes towards teaching and perceptions of departmental value placed on teaching. The current study addressed this problem through close examination of factors that may be related to graduate teaching assistants' teaching attitudes and perceptions of the support for good teaching in their respective mathematics departments.

Research Questions

The study described here aimed to answer the following research questions:

1. Are there differences between the four groups of universities (R/E with training, R/E without training, R/I with training, R/I without training) in regard to math GTAs' perceptions of the support for good teaching in their department?

2. Are there differences between the four groups of universities (R/E with training, R/E without training, R/I with training, R/I without training) in regard to math GTAs' attitudes toward teaching?

3. Is there a correlation between mathematics GTA perceptions of the support for good teaching in their department and mathematics GTA attitudes toward teaching?

4. What are the primary teaching support structures available to math GTAs at participating universities in the four groups (R/E with training, R/E without training, R/I with training, R/I without training)?

Significance of the Study

Use of graduate teaching assistants is a significant part of university life and has been since the late nineteenth century. Due to the prevalent use of GTAs in the teaching of undergraduate level basic courses, poor teaching performance by GTAs can reflect negatively on both departments and universities. The university mission at many institutions involves providing quality undergraduate education (Boyer, 1990), and given that GTAs are responsible for a large portion of this mission, "variables that influence the effectiveness of GTAs in the classroom are critical to discover" (Prieto & Altmaier, 1994, p. 482).

While existing literature is useful, the current study adds to the body of knowledge of GTA characteristics, teaching attitudes, and institutional enculturation. Results of this study may support or refute the theories about postsecondary education described by Boyer (1990) and Eble (1976). In either case, results have potential to

inform the community of institutions employing graduate teaching assistants in mathematics departments about factors which might be associated with the attitudes and perceptions held by these GTAs. It is the author's hope that the information provided as a result of this study will be helpful to administrators at graduate degree granting institutions as the dialogue regarding graduate teaching assistants continues.

<u>Definition of Terms</u>

1. Although definition and duties of *Graduate Teaching Assistants* (identified in the literature as GTAs or TAs) vary from department to department, for the purposes of this study the term refers to a graduate student (masters or doctoral level) with at least partial responsibility for the material taught in an undergraduate level mathematics course. This includes, but is not limited to: tutoring students, grading student work, planning lectures, writing exams, and creating a course syllabus.

2. The *Carnegie Classification System* was established in 1971 in an effort to identify categories of homogeneous colleges and universities with respect to university function and characteristics of students and faculty (Carnegie Foundation, 2001). The 2000 Carnegie Classification of Institutions of Higher Education made minor changes to the original classification system, including discontinuing the use of federal financial support as a category indicator, and was the most current Classification available at the beginning of this dissertation study. The comprehensive list includes all United States colleges and universities that are degree-granting and accredited by a U.S. Secretary of Education

recognized agency. For the purposes of the current study, only institutions classified as doctorate-granting are of interest.

- *Research Universities—Extensive (R/E):* During the 1995-96 through 1997-98 period, these institutions awarded 50 or more doctoral degrees per year across 15 disciplines or more. They are committed to graduate education through the doctorate, and typically offer a wide range of baccalaureate programs as well.

- *Research Universities—Intensive (R/I):* During the time period studied, these institutions awarded 20 or more doctoral degrees overall per year, or at least ten doctoral degrees per year across three or more disciplines. They also typically offer a wide range of baccalaureate programs, and are committed to graduate education through the doctorate (Carnegie Foundation, 2001).

3. The definition of *GTA Training* is "not agreed upon across, or even within academic disciplines" (Shannon, Twale, & Moore, 1998, p. 457). For purposes of this study, the term refers to activities designed to foster teaching abilities and increase the quality of instruction delivered by GTAs. Because professional development literature indicates that a substantial number of contact hours sustained over a long period of time has a stronger impact on teaching (e.g., Garet, Birman, Porter, Desimone & Herman, 1999; Loucks-Horsley, Hewson, Love, & Stiles, 1998), span and duration of GTA training are important considerations.

- Those institutions offering departmental or university GTA training of a span of at least five days will be classified as *with training*. This is intended to exclude regularly scheduled staff meetings with a GTA's basic course supervisor.

- Those institutions offering no GTA training, or offering only GTA trainings with span and duration of less than five days will be classified as *without training*.

4. *General Teaching Effectiveness* is the "degree to which one has facilitated student achievement of educational goals" (McKeachie, 1994, p. 315). The research reviewed allowed for personal teaching effectiveness to be classified into the following five categories:

    (1) strong knowledge of content/subject matter being taught

    (2) interest in students/fostering a positive learning environment

    (3) organization, preparation, and clarity of presentation

    (4) enthusiasm/positive attitude towards teaching

    (5) prompt feedback and fairness in grading.

For the purposes of this study, only the attitude category (4, above) will be addressed.

Organization of the Study

Chapter 1 provided an overview of the study, including background information about the graduate teaching assistantship and its relative importance to the university mission. The research questions were stated, and key terms were defined for the reader.

In Chapter 2, relevant literature related to the teaching assistantship is discussed. Studies are organized under the categories of The GTA Experience, GTA Training and Development, and Teaching Effectiveness. The theoretical framework which guided the current study is also discussed.

Chapter 3 describes the participants, data collection methods, instrumentation, and data analysis procedures used in this study. The research questions are restated, variables of interest are identified, and assumptions and limitations inherent in the research design are described.

Chapter 4 details the results of the study, presented in the order of the research questions. Following the results is Chapter 5 with a summary of the study and a discussion of the implications of the findings of this study for both researchers and practitioners.

CHAPTER 2

REVIEW OF THE LITERATURE

The review of literature is comprised of three categories related to graduate

teaching assistants, referred to as GTAs or TAs throughout the literature. The first of

these is research related to The GTA Experience and includes studies which describe the

role of GTAs in colleges and universities in the United States. Because the current study

sought to examine variables associated with GTA attitudes toward teaching, the next

categories are GTA Training and Development, and finally Teaching Effectiveness.

Following is the theoretical framework which guided the current study. This consisted of

work in the field of teaching effectiveness at the postsecondary level, and extensive

research on the culture and mission of the university.

The GTA Experience

Diamond and Gray (1987) distributed the National Graduate Teaching

Assistant/Associates Survey to teaching assistants at eight public and private research

universities located in diverse geographic areas. The authors' objectives were to provide

insights into GTAs' situations across institutions and to form a basis for making

recommendations about the development of institutional programs to prepare and support

graduate teaching assistants. The survey was developed through the cooperation of the

participating institutions and consisted of five sections including: (1) demographic

information; (2) teaching responsibilities and supervision; (3) preparation for teaching

including prior experience, training offered, areas of preparation received and areas of

preparation desired; (4) items especially related to international GTAs; and (5) a section for general comments and suggestions.

A total of 1,357 GTAs in a variety of academic disciplines responded to the national survey, 59% of whom were male, 41% of whom were female. About 75% of respondents planned to teach at a college or university after graduation, supporting the authors' assertion that "the teaching assistants of today are the potential faculty members of tomorrow" (Diamond & Gray, 1987, p. 1). Regarding teaching responsibility, at least 60% of the GTAs surveyed indicated being responsible for each of the tasks of: grading (97%), holding office hours (94%), preparing tests (72%), leading class discussions (71%), conducting review sessions (69%), and lecturing (60%). At least 75% of GTAs surveyed felt that they had received adequate supervision in each of the above areas. In general, when asked about having received adequate guidance and supervision from the department in which they teach, 80% of GTAs responded "yes." Fewer females (79%) than males (84%) reported generally adequate supervision, but there were no important differences between national and international GTAs.

Almost all responding GTAs (96%) felt that their academic background was adequate for their teaching responsibilities. Twenty-one percent of respondents felt they did not have enough time to adequately fulfill their teaching responsibilities, with more females (27%) than males (16%) indicating such. Questions about prior experience and training revealed that 65% of respondents had participated in a university or departmental training program, 44% of GTAs had previously held a teaching position, and 31% had taught at the K-12 level. The authors suggested that "graduate teaching assistants'

efforts… should be recognized for their essential contribution to the accomplishment of the mission of the institution and should be rewarded accordingly" (Diamond & Gray, 1987, p. 7).

In *Graduate Teaching Assistant (GTA) Training: The View From the Top*, Buerkel-Rothfuss and Gray (1989) gathered information about GTA training from the perspective of graduate school deans (the administrators most likely to have first-hand knowledge of campus-wide training programs) and department chairs/heads (those most likely to have information about departmental training programs) at universities across the United States. Completed surveys were collected from 164 graduate deans and 339 department chairs/heads; over one hundred administrators also included copies of campus-wide and departmental training materials such as handbooks and evaluation forms. The distributed questionnaires included both open- and closed-ended questions dealing with: institutional and departmental demographics; GTA selection and limitations on teaching responsibility; nature of campus and departmental training provided; perceptions of ideal training programs, and types of training desired; and problems that interfere with the availability of training.

According to Buerkel-Rothfuss and Gray (1989), the most common type of campus-wide training was a one-day session prior to the start of the fall semester. Just over one-fourth of schools offered any campus-wide training, and of these, only 12% offered a one-week or longer training session. The largest source of funding for GTA training (44.4%) was the university general fund, with funding also contributed by the provost's office or the graduate dean's office. When graduate deans at schools where

campus-wide training was not available were asked to rate the importance of teacher

training for new GTAs "'in general,' the resultant mean was 7.5 on a 9-point scale (1=not

at all important; 9=essential), indicating that the majority of deans felt that such training

was nearly essential" (p. 12). Interestingly, a noticeable difference appeared between

what deans on campuses offering training listed as topics covered during training and

what deans on campuses not offering training would like to see discussed in GTA

training. For example, exam writing, building classroom climate and rapport, and

building interest in course content were the three most commonly discussed topics at

institutions where training was offered. Deans on campuses not offering training listed

teaching strategies, grading course assignments, and providing constructive criticism as

the three most desired training topics.

Departmentally, GTAs who handled teaching responsibilities on their own

generated about one-fourth (22.8%) of the total student credit hours offered by their

departments. A little over half of the departments surveyed offered some sort of

departmental training, with the majority of those (84%) offering one week of training

prior to the beginning of school. Other departmental trainings lasted for the entire fall

semester, or for just a few hours before the term began. When rating issues that interfere

with preparing GTAs to teach, 21.8% of department heads reported "a tendency for

faculty to place priority for GTA performance on research, not teaching" and 20.9% of

department heads reported "a prevailing attitude that teaching improves with practice, not

training" (Buerkel-Rothfuss & Gray, 1989, p. 19). Overall, these findings indicate that

although GTAs are responsible for a large portion of university student credit hours (up

to 95% in some departments), nearly half of GTAs do not receive training of any kind for their role as a university instructor.

Smith (2001) investigated how highly successful teaching assistants view their graduate teaching experiences in preparing them to be successful faculty at a variety of institutions. Her longitudinal study used data from 96 teaching assistants and faculty who participated in the Teaching Assistant Mentor Program at The University of Georgia. Each year for ten years, ten to fifteen GTAs were selected as highly successful graduate students from a variety of disciplines to participate in a year-long mentoring experience. Past and present mentors were invited to participate in a private on-line teaching discussion. Data consisted of transcriptions of the following: qualitative interviews, observations, group discussions on teaching, and the on-line discussions. There were also data available from questionnaires mailed to TA Mentors who had moved into faculty positions. The term "highly successful" referred to graduate students' abilities to manage very complicated schedules, conduct significant research to complete a doctorate, and be recognized for their outstanding teaching.

GTA participants were able to identify significant negative and positive events and experiences during their time as graduate students which influenced their successful transition into university faculty positions. GTA responses were compared to a list of teaching competencies and skills for TAs and faculty identified by the author (Smith, 2001) in previous research: Scholastic Skills, Planning Skills, Management Skills, Presentation and Communication Skills, Evaluation and Feedback Skills. Positive influences on Scholastic Skills included teaching awards, opportunities to give

presentations and attend conferences, and experiences which fostered a sense of community with other teachers and faculty. Despite extensive teaching responsibilities, many GTAs were still encouraged to focus more on research than on teaching, negatively influencing Scholastic Skills. Planning Skills were developed through opportunities to revise and develop new courses, as well as opportunities to teach a variety of courses in the GTAs' departments. Management Skills were challenged by departments expecting 60-hour work weeks, or those departments that did not provide a well-articulated teaching support structure. Faculty who had learned time management and prioritizing skills as GTAs were more likely to be enthusiastic about their roles as faculty. The most negative experience regarding Presentation and Communication Skills involved a lack of departmental feedback on how well GTAs were working with their students; collaborative teaching and mentoring were positive experiences which improved Presentation and Communication Skills (Smith, 2001). An important component of The University of Georgia's TA Mentoring Program was the creation of a professional portfolio; GTAs listed this as a useful tool in the category of Evaluation and Feedback Skills.

By being a GTA as a graduate student, participants developed an enthusiasm for teaching and a better understanding of how students learn. This is categorized by Smith (2001) as Interpersonal Skills, and it was this enjoyment of teaching that helped new faculty focus on and succeed in teaching. Positive events associated with developing teaching competencies and skills made the shift into a faculty position smoother, and allowed GTAs to transition into successful participants of academic culture. Smith (2001)

"confirmed that teaching must be recognized and validated by the institution to optimize graduate student development as teacher scholars" (p. 103).

Guentzel, Tagliapietra-Nicoli, Whitt, and Elkins (2005) performed a qualitative study attempting to understand and describe the experiences of Chemistry GTAs from their own perspectives. Fifteen GTAs participated in the study from four semesters of the Principles of Chemistry course at a research-extensive university. Ten participants were female, five were male; all participants were either in their first year of Ph.D. studies, or returning students who were not acting as research assistants. Guentzel et al. observed each GTA at least once during his or her discussion section in an effort to examine GTA teaching styles, use of technology, and student engagement. Observations were also used to aid in the design of interview questions about GTA teaching experiences. Each of the fifteen participants was interviewed once with the following purposes in mind: (1) to learn about GTA backgrounds in academics and teaching; (2) to gain insight into the experience of being a Chemistry GTA from the GTA's point of view; (3) to investigate GTAs' understanding of their roles and responsibilities with regards to the discussion sections they lead; and (4) to "gain insight into the GTA's perceptions of their preparation to be a GTA" (2005, p. 16).

Analysis of the interview transcripts yielded six major themes, which were the understanding of GTA roles; teaching experience and training; frustration with students; uncertainty about teaching abilities; rewards and benefits of being a GTA; and suggestions for improvement. Guentzel et al. note that "most of the information the GTAs provided reflected negative experiences and attitudes" (2005, p. 18). Although GTAs

were comfortable with the Chemistry material and felt they understood the expectations the course supervisor had of them, some felt young and therefore not an authority figure in the classroom, many felt that their lack of formal training for their position contributed to anxiety and negative experiences in the classroom. Two positive comments about the GTA experience included the rewards of watching a struggling student excel, and using teaching to reinforce Chemistry material for the GTAs' own use.

The participating Chemistry GTAs used their own struggles to make suggestions for ways in which the department and university can help with their preparedness. These suggestions included observing other GTAs leading discussions, practicing teaching to other GTAs for feedback, and stronger connections between the Chemistry department and the department of science education. Guentzel et al. (2005) emphasize the need for commitment to undergraduate education and teacher development through altering traditional practices and recognizing that GTAs are the main point of contact between curriculum and undergraduates and also between current faculty and the new professoriate. GTAs play a key role in Chemistry departments and also across the university system.

Focusing specifically on graduate mathematics teaching assistants—referred to in the study as "GMTAs"—Belnap's (2005) yearlong qualitative study explored the experiences of GMTAs and ways in which their teaching practices and beliefs are developed. Eight GMTAs were purposively selected and studied, and in-depth details of the experiences of three of these GMTAs constitute Chapter 4 of the dissertation. The participants were equally four male and four female; they were studying applied

mathematics, pure mathematics and math education; their years of teaching experience as a GMTA ranged from zero to three with four GMTAs having no prior experience. Data were collected through use of: (1) semi-structured interviews with each participant, conducted across both fall and spring semesters of the study year; (2) interviews with course supervisors; (3) observations of supervisor/GMTA meetings; (4) observations of GMTAs teaching (ranging by participant from seven classroom visits across two semesters to two classroom visits in the fall); (5) observations of the campus-wide TA training program, the mathematics departmental training program, and the year-long departmental teaching training course; and (6) writing assignments obtained from GMTAs through their participation in the departmental teaching training course.

Belnap (2005) coded interviews and written assignments (sources 1 and 6 above) into two main categories of comments. The first of these is the challenges and difficulties experienced by GMTAs, including internal conflicts like priorities of the GMTA, social conflicts like authority figures, and contextual conflicts like the content and course being taught. For example, one of the new GMTAs felt that if the department was concerned with time focused on being a graduate student, then she wouldn't be required to teach as a GMTA. The second category of comments were factors which impact GMTA teaching views and practices, including internal factors like experience and beliefs, and external factors like colleagues, advisors, course design and resources, and students. The three GMTAs focused on in Chapter 4 of the dissertation found their peers, other instructors, and their course supervisors to serve as a support network and as a resource in developing their teaching practices and beliefs. Providing GMTAs with a support structure is

something that departments and GTA preparation programs can do to aid with teaching development.

The external factor of GMTA Preparation Programs was more closely examined and subdivided into views and attitudes toward preparation programs; incorporation of preparation programs by GMTAs into their teaching style; and suggestions for GMTA preparation programs. Although there was a great deal of accuracy in GMTAs' descriptions of their teaching practices, Belnap (2005) found that GMTAs were not always aware of the influence that preparation programs were having on their teaching practices and beliefs. Observing over an extended period and being familiar with the content and style of the preparation programs allowed Belnap to recognize their impact on the GMTAs' teaching practices and beliefs. As a result, Belnap suggested caution in using only GMTA-reported perceptions of the (positive and negative) effects of a TA training program.

In general, university graduate teaching assistants are responsible for a large portion of undergraduate student credit hours and hold responsibilities including grading, preparing tests, lecturing and holding office hours (Buerkel-Rothfuss & Gray, 1989; Diamond & Gray, 1987). Graduate students who had successfully transitioned from the role of GTA to faculty member attributed this to experiences teaching a variety of courses and practice with time management as a GTA (Smith, 2001). A relative emphasis on research over teaching not only interfered with availability of GTA training (Buerkel-Rothfuss & Gray, 1989), but negatively influenced GTAs' Scholastic Skills as they transitioned into faculty positions (Smith, 2001). Nearly half of GTAs did not receive

training of any kind according to university administrators (Buerkel-Rothfuss & Gray,

1989). However, in a survey of GTAs (Diamond & Gray, 1987), over 75% of GTAs felt

that they had adequate guidance and supervision for their instructional role.

<u>GTA Training and Development</u>

There is a somewhat large body of literature on training programs for GTAs, but

few articles specifically address GTAs' concerns regarding their own pedagogical

training and development. In *Graduate Teaching Assistant (GTA) Training: The View*

from the Trenches, Gray and Buerkel-Rothfuss (1989) contributed data to answer the

question "what do GTAs need?" (p. 6). One of the most used sources of funding for

graduate students' educations at many colleges and universities is the graduate

assistantship, and the use of graduate teaching assistants is more common than the use of

graduate research assistants. Graduate teaching assistantships benefit departments and

GTAs in a variety of ways but have one potential drawback: if the quality of basic

undergraduate courses taught by GTAs is poor, this reflects directly on the department

and may damage the program.

Gray and Buerkel-Rothfuss's (1989) study assessed questionnaire data provided

by 207 GTAs who had taught for a semester or longer and 322 GTAs who had not yet

taught. The questionnaire addressed GTA perceptions and characteristics in the following

seven areas: (1) demographic characteristics and teaching responsibilities; (2) training

experiences; (3) evaluations of training experiences; (4) supervision or ongoing/follow-

up training activities and evaluations of those follow-up activities; (5) perceptions of their

teaching ability and the degree to which training affected that ability; (6) perceived needs as GTAs and the importance of various activities for meeting those needs; and (7) overall satisfaction with their graduate teaching assistantships.

This comprehensive picture of GTA perceptions concerning their assistantship preparation and supervision indicated that only about half of the returning GTAs had received any training for their assistantships. Over three-fourths of those who had been trained experienced a training program that lasted for a week or less. Similarly, just over half of new GTAs indicated that they would receive training, and 90% of those who would be trained indicated a training program of one week or less (Gray & Buerkel-Rothfuss, 1989). The results of this study suggest that although new and returning GTAs felt prepared for their teaching responsibilities, they also valued training in areas of teaching effectiveness, and expressed a desire to receive help in all areas of teaching. The authors recommended more systematic development and evaluation of GTA training practices, and comprehensive research about GTA teaching effectiveness from course supervisor or undergraduate student points of view.

In 1993 Talkakar, Micceri, and Eison investigated training needs and preferences of graduate teaching assistants using a survey instrument at the University of South Florida. The authors' investigation of the literature indicated that in designing and implementing training programs, input from GTAs had rarely been sought. Talkakar et al. believed that institutional researchers had the opportunity to systematically identify training needs and concerns of GTAs and thus contribute to the design and implementation of future training programs. They sought to answer the following

questions: (1) what are the major instructional responsibilities of current GTAs?; (2) how do GTAs rate their instructional skills?; and (3) in what instructional skills would GTAs most like to receive training and be most likely to attend training workshops?

Talkakar et al. (1993) created a survey instrument identifying 21 instructional skills on which respondents rated their skill level on a three point Likert-type scale (Poor, Good, Excellent). Survey instruments were distributed to all University of South Florida graduate assistants, with 251 completed questionnaires being returned. Of these, 160 were from teaching assistants. In response to demographic questions, about half of the respondents were working towards their second post-baccalaureate degree, and more than half of the GTAs indicated that they had received some training to teach. For the 21 instructional skills, most responses fell into the "Good" or "Excellent" skill levels. When asked to consider these same 21 instructional skills as training workshop topics and to indicate how likely they would be to attend the training, at least 40% of participants were interested in each of 17 of the 21 topics, including lecturing, motivating students, understanding student characteristics, conducting classroom discussions, and self-evaluation as a teacher.

Seven questions regarding GTA attitudes towards teaching indicated that while 95.6% of respondents enjoyed teaching, 50.6% of GTAs felt that teaching interfered with other graduate school responsibilities. This perceived conflict between teaching and research was supported by the fact that over half of the GTAs surveyed (56.3%) felt that research appeared more highly valued than teaching in their department. While faculty instructional skills were rarely evaluated, research publications were carefully regarded.

"Changing the attitude of these graduate GTAs will have to be preceded by a change in the orientation of academe" (Talkakar et al., 1993, p. 10).

Shannon, Twale, and Moore (1998) investigated the impact of training and teaching experience on GTA teaching effectiveness. One hundred twenty-nine graduate assistants in a variety of subject areas, and the undergraduate students enrolled in the GTAs' classes, participated in the study. These GTAs were identified as independently responsible for teaching at least one undergraduate class. Data about teaching effectiveness were collected using Likert-type scale items adapted from the Student Evaluation of Educational Quality (SEEQ) and completed by each GTA and each GTA's class. The SEEQ is considered reliable in a variety of disciplines, with student ratings generating higher internal consistency than GTA self-ratings. The version of the SEEQ completed by the GTAs also contained demographic questions, including previous GTA training, previous teaching experience and area of academic discipline. GTAs consistently rated their teaching effectiveness significantly more positively than did their students.

Shannon et al. (1998) first addressed the impact of GTA training on both GTA and undergraduate student perceptions of GTA teaching effectiveness. Types of training were classified as university training, departmental training, and an undergraduate degree in education. Although having an undergraduate degree in education is less common among GTAs, this was the only type of training that was associated with significantly higher effectiveness ratings by both students and GTAs. An undergraduate degree in education is a far more comprehensive training in pedagogical methods than either the

typical one-day university training or a departmental training which varies greatly across academic areas.

Their second research question addressed prior teaching experience, which was categorized by previous GTA experience, college teaching excluding prior GTA assignments, and experience teaching in a K-12 classroom. GTAs with previous K-12 or college teaching experience earned significantly higher teaching effectiveness ratings from both students and GTAs than those without experience. Lastly, Shannon et al. (1998) compared GTAs from four academic disciplines with respect to students' and GTAs' perceptions of teaching effectiveness. GTAs from the College of Education and the College of Liberal Arts were rated significantly more effective than those from the College of Engineering and the College of Science and Math.

Based on the significantly higher effectiveness of those GTAs with undergraduate degrees in education and those GTAs with prior K-12 teaching experience, the authors recommended improving the structure of GTA training to include experiences beyond those usually offered in university or departmental trainings. To help GTAs become adequately prepared to teach undergraduates, the structure of GTA training must shift from coverage of university and departmental policies and procedures to training designed to foster teaching ability. "Successful programs designed to honor good teaching must be consistent with the mission of the institution" (Shannon, et al., 1998, p. 459).

A qualitative study by DeFranco and McGivney-Burelle (2001) investigated the impacts of a mathematics pedagogy course on mathematics TAs' classroom practice and

their beliefs about mathematics, mathematics teaching and learning. Twenty-two teaching assistants—all working toward either a masters degree or Ph.D. in mathematics—participated in a required, department-sponsored mathematics pedagogy course. These TAs came from a variety of backgrounds, were each teaching two remedial-level mathematics courses for the mathematics department, and none had prior formal training in teaching. In the department where the study was conducted, there was an emphasis on the "transmission method of teaching" (p. 684), and as a Carnegie I Research Institution, many faculty believed their responsibility was to conduct research and publish results. Data for the study were collected throughout the duration of the pedagogy course, including (1) interviews prior to the start of the pedagogy course and at its completion; (2) TA journals throughout the semester regarding their teaching experiences; (3) written open-ended responses to questions about the particular day's discussion topic throughout the pedagogy course; and (4) each TA had a lesson observed and videotaped by a faculty member after which the TA watched and commented on his/her teaching performance.

Without prior teaching training, many TAs' knowledge of teaching came from their own experiences as students. In general, before the pedagogy course TAs believed effective teachers were primarily knowledgeable in their field and would teach by "giving knowledge to students" (DeFranco and McGivney-Burelle, 2001, p. 685). By the end of the course, the mathematics TAs recognized that their long-held beliefs about teaching and learning mathematics had been challenged. Positive TA comments included TAs learning that teaching is about helping students to understand rather than a teacher telling students information to memorize, and TAs describing the journaling exercises as aiding

in their teaching through reflection. Although TA beliefs appear to have changed through the semester-long study and pedagogy course, classroom observations at the end of the semester revealed TAs primarily utilizing lecture style instruction, and little student-interaction in the classroom. DeFranco and McGivney-Burelle (2001) analyzed the differences between mathematics TAs' proclaimed beliefs and observed teaching styles to be reflective of the culture of not only their present mathematics department, but also the culture of years of school experiences. Although the mathematics pedagogy course had value, it was too minor of an aspect of the TAs' enculturation and schooling experiences to be reflected in the classroom. The authors recommended that universities and mathematics departments adjust the cultural norms in an effort to use research to inform teaching and to engage TAs in a continuous dialogue about pedagogy and teaching.

Taken together, this literature regarding GTA training and development indicates that only about half of GTAs were given opportunities for training for their teaching responsibilities (Gray & Buerkel-Rothfuss, 1989). GTAs felt confident in their teaching skills, and consistently rated themselves as good instructors (Gray & Buerkel-Rothfuss, 1989; Shannon et al., 1998; Talkakar et al., 1993). This being said, in the comprehensive Shannon et al. (1998) study only prior teaching experience and/or the intense pedagogical training experienced while earning an undergraduate education degree warranted higher teaching effectiveness ratings by GTAs' undergraduate students. Despite their confidence, GTAs valued training and expressed interest in receiving help in topics like lecturing, motivating students, and self-evaluation as a teacher (Gray & Buerkel-Rothfuss, 1989; Talkakar et al., 1993). DeFranco & McGivney-Burelle (2001) and

Talkakar et al. (1993) mentioned the importance of both training and departmental culture in GTA professional development.

<div align="center">Teaching Effectiveness</div>

In her 1989 dissertation from Florida State University, Lumsden assessed the effects of a teaching workshop for new biology graduate teaching assistants on their teaching performance, teaching effectiveness, and attitudes toward teaching and students. Begun in 1987, the workshop was a regularly scheduled course lasting the duration of the week before classes began in the fall. It addressed teaching skills, presentation and learning styles, time and practice for preparation, and the importance of positive attitudes toward teaching and students. These course topics were based on Lumsden's review of the literature on effective teaching which fell into the following seven categories of behaviors or skills utilized: feedback/correctives by the teacher, personality/character of the teacher, teacher preparation and presentation, positive attitude of the teacher, good classroom management, organization, and attention to all students.

Lumsden (1989) collected data from 32 masters and doctorate level biology graduate students across four terms (Fall 1987, Spring 1988, Summer 1988, Fall 1988). Each GTA taught three sections of freshmen biology lab. The control group consisted of 10 GTAs who entered their program of study in Spring 1988 so were unable to attend the workshop in the fall. The experimental group consisted of 22 GTAs who began teaching in the fall of 1987 and attended the workshop prior to teaching.

Lumsden (1989) collected data about the effects of the teaching workshop

through six measurement sources. (1) The Student Instructional Rating Survey measuring

overall teacher effectiveness was a teaching evaluation instrument offered to every

instructor at Florida State University and completed by the instructor's students. (2) The

Science Laboratory Environment Inventory collected data about the effectiveness of

teachers in a laboratory setting, and was also completed by undergraduate students. (3)

Lumsden conducted interviews with individual GTAs and (4) developed a set of open-

ended questions to use in group interviews with one entire class of each GTA. (5) A

comparison of final exam grades was used to show how effectively the GTA conveyed

the course information; four versions of a supervisor-created final were distributed

among all the sections of freshman biology. (6) An experienced science educator, who

was not aware of which GTAs had attended the workshop and which had not, made

classroom observations of each GTA.

Lumsden's findings were more strongly supported through the qualitative

measures (3, 4, and 6) than quantitative measures (1, 2, and 5). Lumsden stated that "if

the TAs thought the department/university placed value on effective teaching, they

seemed to place value on effective teaching" (1989, p. 81). According to measures 4 and

6 the teaching workshop did improve teaching performance of GTAs in freshman biology

classes, but the quantitative data analysis indicated that the improvement was not

statistically significant (measures 1 and 2). The measure of student achievement (5)

indicated that effectiveness of GTAs involved in the seminar did not increase

significantly. GTA interviews (measure 3) indicated that attitudes of GTAs towards the

importance of teaching improved as a result of the one week teaching workshop. In

conclusion, Lumsden (1989) found that GTAs in freshman nonmajor biology classes

improved their teaching and their attitudes toward teaching as a result of the one week

teaching workshop.

In 1996, Moore assessed college teaching effectiveness through a comparison of

graduate teaching assistants' self-perceptions of effectiveness and their students' course

evaluations. The author addressed the following questions:

> (1) Is there a significant difference between graduate teaching assistants'
> perceptions of their teaching effectiveness and their students' evaluations of their
> teaching performance?
> (2) Does previous teacher preparation or previous teaching experience affect a
> graduate teaching assistant's perception of his/her teaching effectiveness?
> (3) What are the graduate teaching assistants' perceived pedagogical needs at this
> university? (p. 32)

A total of 129 GTAs in a variety of disciplines at Auburn University and 3,088 of

these GTAs' undergraduate students provided data for the study. The Student Evaluation

of Educational Quality (SEEQ) was adapted for use with both the undergraduate students

and the graduate teaching assistants. According to factor analysis, items on this

instrument are consistently identified by the following nine factors of instruction: (1)

Learning/Value, (2) Enthusiasm, (3) Organization, (4) Group Interaction, (5) Individual

Rapport, (6) Breadth of Coverage, (7) Examinations and Grading, (8) Assignments, and

(9) Workload/Difficulty (Moore, 1996). Demographic questions (university class level,

gender, GPA) were added to the SEEQ administered to undergraduate students.

Demographic questions, questions regarding prior teaching experience and training, and

an open-ended question regarding comments on what Auburn University could do to

improve GTA instruction were added to the SEEQ administered to GTAs. The SEEQ items on the version administered to GTAs were also altered to read in the first-person.

In response to Moore's first research question, there was consistency between GTAs and their students in terms of which factors were determined areas of highest effectiveness. However, GTAs rated themselves more effective than did the undergraduates on eight of the nine SEEQ factors of effective teaching (factors 2 through 9) at levels that are statistically significant (Moore, 1996). Regarding his second research question, there was an overall statistically significant difference between groups who attended a university-sponsored GTA Orientation Program and those who didn't. Those who attended the Orientation Program perceived themselves more effective on factors 5, 7, and 9. GTAs with an undergraduate degree in education perceived themselves to be more effective on factors 7 and 9 than those who didn't have an undergraduate degree in education at a level that is statistically significant. Those GTAs with previous K-12 teaching experience perceived themselves to be more effective on factors 1, 2, 5 and 7 than GTAs without; those GTAs with previous college teaching experience perceived themselves to be more effective on factors 1, 2, and 8 than those GTAs without. These differences were statistically significant. Responses to Moore's third research question were categorized into suggestions for improving the classroom environment (class size, text used, classroom facilities); establishing guidelines and pre-requisites for GTAs to meet before they are allowed to teach (experience, language proficiency); and forming teacher education/training services for GTAs (written materials or course guidelines, mentoring, specialized departmental training, recognizing teaching excellence). It seems

that attending a university-sponsored GTA Orientation Program and prior teaching experience both positively influenced GTAs' self-efficacy.

Moore (1996) noted that although undergraduate students and GTAs agreed that the GTAs had taught effectively, the GTAs surveyed "felt the need for more training and experience before being allowed independent classroom responsibility" (p. 87). Moore asserts that providing required training for GTAs would support Auburn University's undergraduate teaching mission.

McGivney-Burelle, DeFranco, Vinsonhaler, and Santucci (2001) initiated a multi-year study to investigate how a pedagogy course in mathematics challenged teaching assistants' beliefs about mathematics, and informed their teaching practices. Specific research questions focused on (1) effects of the pedagogy course on GTAs' beliefs about mathematics teaching and learning, and (2) factors which prevented GTAs from changing their classroom practice. Five seminar-style classes were held in Fall 2000 at the University of Connecticut and attended by an average of 22 GTAs and 5 faculty members.

Qualitative data were collected through use of interviews with the math GTAs prior to the pedagogy course regarding the nature of math, students' learning of math, and course goals. Other data collected were GTA journal entries throughout the semester, class assignment sheets regarding the day's pedagogy discussion, and videotaped observations of GTAs teaching (McGivney-Burelle et al., 2001). At the outset of the pedagogy course, GTAs were asked to rank seven teaching attributes based on how helpful each was for the learning of mathematics. The GTAs indicated that effective

instructors: (1) deliver well-organized lectures, (2) are knowledgeable of subject matter, (3) grade fairly, (4) are available for help, (5) stimulate interest, (6) grade and return work promptly, and (7) know students' names.

In response to the authors' first research question, the majority of GTAs indicated that the mathematics pedagogy course challenged their long-held beliefs about the teaching and learning of mathematics. However, in response to the second research question, despite the course, GTAs did not change their classroom practice. Specific factors which influenced this lack of behavioral change included the rigid nature of course syllabi, the issue of time both in and outside the classroom, and the culture of the GTAs' departments. "[I]f TAs are expected to become more effective teachers, university norms and cultural values of mathematics departments need to change, to promote a climate that supports and rewards effective teaching practice" (McGivney-Burelle et al., 2001, p. 62).

Prieto and Altmaier (1994) investigated teacher self-efficacy as a mediating variable between teacher effectiveness and student achievement. Throughout their report, the authors suggested that teachers (in this case, graduate teaching assistants or GTAs) who have higher self-efficacy may in fact have the ability to teach more effectively and as a result improve their students' academic performance. Seventy-eight surveys were completed and returned by GTAs in a variety of disciplines at the University of Iowa in Fall 1992. The survey used was an adapted form of the highly reliable (α=.94) Self-Efficacy Toward Teaching Inventory (SETI), which asks participants to rate their sense of confidence in a variety of teaching behaviors across these five teaching domains:

Course Preparation, Instructor Behavior, Materials, Evaluation and Examination, and Clinical Skills Training. The original SETI is related to Counselor Education, so modifications included the removal of three counseling-specific items, and the addition of a demographic questionnaire.

Descriptive results indicated that there were no significant differences at the .05 level in GTA self-efficacy with regards to gender, race, future intentions of teaching, degree of study, or level of teaching responsibility in the classroom. However, those GTAs who received prior training scored significantly higher in self-efficacy than those GTAs who had received no prior training (Prieto & Altmaier, 1994). Statistical results presented a significant correlation between previous teaching experience and prior training and between previous teaching experience and teaching career plans. Continued investigation into the "factors that influence the self-efficacy and teaching effectiveness of GTAs is of great import… given that the prevalent use of GTAs as course instructors will likely be maintained at current levels, if not increased as time goes on" (p. 495).

The literature on teaching effectiveness is difficult to separate from the literature on GTA training, as one of the most relevant measures of GTA training can be its impact on teaching effectiveness. Instruments used by Lumsden (1989), Moore (1996), and Prieto and Altmaier (1994) indicate the importance of knowledge of presentation and learning styles, positive attitudes towards students and teaching, and skills in creating and grading assignments when considering attributes of effective instructors. Recommendations from GTAs to support and facilitate improved teaching included more training and clearer guidelines for GTAs to meet before they enter the classroom (Moore,

1996), as well as a departmental environment that was more supportive of good teaching (McGivney-Burelle et al., 2001).

Theoretical Framework

The questions and methods of this study were guided by the works of two experts in postsecondary education. As a result of investigations of literature by Eble and Boyer, important considerations were made regarding teaching effectiveness at the postsecondary level, as well as the mission of universities in the United States. A detailed description of the influences of theory on the specific research questions is found in Chapter 1.

Postsecondary Teaching Effectiveness

As a specialist in improving college and university teaching, Kenneth Eble has spent a lifetime thinking about what it means to be an effective teacher. *The Craft of Teaching* (1976, and subsequent editions) and *The Aims of College Teaching* (1983) are referenced throughout literature on teaching effectiveness and often included in recommended reading lists for new teaching assistants (Bingman, 1983; Buerkel-Rothfuss & Gray, 1989; Lumsden, 1989; Nyquist & Wulff, 1986; Prieto & Myers, 2001; Ralph, 2001). Through experiences as a classroom teacher and years spent observing and discussing with other classroom teachers, Eble has created lists of personal characteristics that are attributed to effective teachers, and lists of suggestions for making a class run successfully. Although these lists are neither exhaustive nor precise, they better serve new teachers than claiming no system for judging effective teaching exists (1976).

A primary university responsibility is to provide quality undergraduate education, and efforts made to improve college graduates must be aimed at improving college instructors and instruction (1983). Eble recognized that even good teachers continue to learn and promoted a graduate teaching assistant seminar as an effective opportunity for discussing experiences and exchanging information about teaching. Support of teaching at the university level is critical since "teaching skill is not so much taught as it is nurtured into existence" (1976, p. 154). This nurturing is more efficiently delivered via a training session than merely through experience teaching.

<u>University Culture and Mission</u>

In 1990, as president of the Carnegie Foundation for the Advancement of Teaching, Ernest Boyer published *Scholarship Reconsidered: Priorities of the Professoriate*. Boyer described how undergraduates were being aggressively recruited to campuses where research was emphasized and teaching went unrewarded. Boyer examined the history of institutions of higher learning in the United States as well as the results of a National Survey of Faculty, and defined a new future for what is considered scholarship at colleges and universities nationwide. The new role of the professoriate includes "four separate, yet overlapping functions. These are: the scholarship of *discovery*; the scholarship of *integration*, the scholarship of *application*; and the scholarship of *teaching*" (p. 16, emphasis in original). According to Boyer, it is at doctorate-granting universities (where use of teaching assistants is most prevalent) that the greatest need exists for teaching and research to attain a better balance.

In redefining the priorities of the professoriate, new university missions must be clearly defined and communicated among a community of scholars on campuses across the United States. It is the responsibility of administrators and faculty alike to promote the transmission and extension of knowledge through teaching at postsecondary institutions. Simply by being in existence, "teaching assistant programs… are crucial in the preparation of future teachers" (p. 71). Boyer recommended that graduate schools give priority to teaching, specifically urging that every graduate student participate in a seminar on teaching.

Summary

Studying literature about graduate teaching assistants and university teaching in general provided background and guidance for both the design of the current study and for the interpretation of results. With graduate teaching assistants responsible for about 25% of the student credit hours offered by their departments (Buerkel-Rothfuss & Gray, 1989) and a majority of GTAs (75%) planning to teach at a college or university after graduation (Diamond & Gray, 1987), "the long-term benefit of improved teaching skills of teaching assistants is the general improvement of post-secondary teaching" (Graff, 1994, p. 66). Many events and experiences as a graduate student, and specifically as a teaching assistant, have been found to influence the transition into a faculty position after graduation (Smith, 2001).

According to the literature barely half of GTAs were offered any training for their teaching assistantship, with the most common type of training offered lasting less than

one week prior to the beginning of the semester (Buerkel-Rothfuss & Gray, 1989; Gray & Buerkel-Rothfuss, 1989). This is despite research indicating not only GTA interest in training and help improving teaching skills (Gray & Buerkel-Rothfuss, 1989; Talkakar et al., 1993) but also the positive impacts of training on teaching effectiveness and attitudes towards teaching (Lumsden, 1989; McGivney-Burelle et al., 2001; Moore, 1996; Prieto & Altmaier, 1994). Also noted by administrators (Buerkel-Rothfuss & Gray, 1989), teaching assistants (Lumsden, 1989; McGivney-Burelle et al., 2001; Moore, 1996; Talkakar et al., 1993; Smith, 2001), and experienced researchers (Diamond & Gray, 1987; Shannon et al., 1998), the priority at many institutions and in many departments is research, not teaching. Considering that multiple researchers describe the influence of departmental or university culture (Boyer, 1990; DeFranco & McGivney-Burelle, 2001; Eble, 1983; Talkakar et al., 1993), in order to optimize graduate student development and effective undergraduate instruction, good teaching by mathematics graduate teaching assistants must be recognized and supported.

Chapter 3 follows with a description of the research methods, including sample and data collection. Chapter 4 details quantitative and qualitative results of the current study, presented in an order corresponding to the research questions. In the final chapter, a discussion of the results is presented, including summary and implications of study findings.

CHAPTER 3

METHODOLOGY

Graduate teaching assistants are responsible for much of undergraduate education in universities across the United States. Typically, teaching provided by GTAs is financially beneficial to the GTAs and to the department they are teaching for. Undergraduate students may also benefit from working with GTAs (Gray & Buerkel-Rothfuss, 1989), and practice as a teaching assistant may be the only teaching experience many graduate students receive before being hired to faculty positions. However, poor teaching performance by GTAs reflects negatively on the department and university, especially at institutions where undergraduate students have more direct contact with GTAs than with professors. A variety of studies indicate that faculty and GTAs alike participate in what is rewarded; if the institution values teaching, so will its instructors (e.g., Barrington, 2001; Diamond & Gray, 1987; McGivney-Burelle et al., 2001). Therefore, it appears important to support GTAs and work toward increasing their teaching effectiveness. The current study investigated factors that may be related to graduate teaching assistants' attitudes towards teaching and perceptions of the importance of teaching in their departments.

Research Questions

The research questions addressed by this study are:

1. Are there differences between the four groups of universities (R/E with training, R/E without training, R/I with training, R/I without training) in regard to math GTAs' perceptions of the support for good teaching in their department?

2. Are there differences between the four groups of universities (R/E with training, R/E without training, R/I with training, R/I without training) in regard to math GTAs' attitudes toward teaching?

3. Is there a correlation between mathematics GTA perceptions of the support for good teaching in their department and mathematics GTA attitudes toward teaching?

4. What are the primary teaching support structures available to math GTAs at participating universities in the four groups (R/E with training, R/E without training, R/I with training, R/I without training)?

The current study answered these questions through use of an associational design. A one-time survey was administered to mathematics GTAs at 29 universities across the United States. Data regarding GTA attitudes toward teaching and GTA perceptions of the support for good teaching in their department were collected through responses to this survey. Further detail regarding study design can be found in this chapter, results are stated in Chapter 4, and discussed in Chapter 5.

Sample

The population of interest for the current study was graduate teaching assistants (GTAs) in mathematics departments at Research Universities - Extensive and Intensive. Participants were selected through use of a stratified cluster sample. Twenty institution

names were drawn without replacement from a complete collection of Research

Universities – Extensive (R/E), as categorized by the Carnegie Foundation (2001).

Twenty institution names were drawn without replacement from a complete collection of

Research Universities – Intensive (R/I). Of the initial 40 institutions selected, 29

mathematics departments agreed to participate fully in the current study. The targeted

sample consisted of 822 mathematics GTAs from 29 mathematics departments.

In total, 822 surveys were mailed to 29 institutions in October and November,

2005. Survey responses were received from 252 mathematics graduate teaching

assistants, representing 13 Research Universities – Extensive and 16 Research

Universities – Intensive. Past research has shown that a single mailing of a survey,

incorporating no incentives for participants, "can probably expect no better than a 20%

response rate" (Bourque & Fielder, 2003, p. 16). For the current study, response rates by

school ranged between 13.89% and 100% with an overall mean survey response rate of

30.66%. The median response rate for Research Extensive Universities was 34.85% and

the median response rate for Research Intensive Universities was 32%; the overall

median response rate was 33.33%.

Each institution selected will remain anonymous throughout the reporting of the

data. They are, however, described using Carnegie Classification, availability of GTA

training, general geographic location, and student population in Chapter 4. Throughout

the results and discussion sections, the institutions are simply referred to by a researcher-

designated code. Participating departments were given the option of receiving a copy of

the study results.

Instrumentation

Attitudes and Support

     In an attempt to investigate correlations between university type and GTA

perceptions of personal teaching effectiveness, the researcher piloted a survey instrument

in April, 2005. A qualitative analysis of literature on teaching effectiveness at the K-12

and university levels (Bingman, 1983; Bort, 1989; Lumsden, 1989; McGivney-Burelle et

al., 2001; McKeachie, 1994; Ralph, 2001; Talkakar et al., 1993) was conducted to

investigate characteristics of effective instructors. Analysis of these characteristics led to

five general categories describing traits of effective teachers:

     1) strong knowledge of content/subject matter being taught

     2) interest in students/fostering a positive learning environment

     3) organization, preparation, and clarity of presentation

     4) enthusiasm/positive attitude towards teaching

     5) prompt feedback and fairness in grading.

     Although this list does not include every trait of an effective teacher, it was

intended to serve as a guide to determine which GTAs perceive their teaching as effective

and to what extent. After establishing these categories, the researcher created a survey

that might obtain background information about each participant, as well as self-

perceptions of personal teaching effectiveness. Retest reliability coefficients for the

instrument were obtained using data from participating GTAs in the researcher's home

institution's mathematics department in April, 2005. As a result, the survey was reduced

to demographic items and items addressing GTAs' enthusiasm and attitudes toward

teaching (category 4 above). This is a category in which reliability coefficients on all

items were above $G=.80$, and additionally, a category in which self-reported data are

often the most informed method of measurement. For complete information regarding the

construction and reliability of the original survey instrument piloted at the researcher's

home institution, please see Appendix A.

The final Teaching Assistant Survey distributed in Fall, 2005 for the current study

consisted of three sections (see Appendix B). The first section addressed participant

demographics or GTA characteristics with 13 items. These included degree currently

working towards, highest degree completed, gender, terms of experience as a math

graduate teaching assistant, experience teaching at the K-12 level, current level of

teaching responsibility, as well as items addressing program of study and status as a

national or international student. The next section related to GTA attitudes towards

teaching, as addressed by four Likert-type scale items. The third and final section of the

Teaching Assistant Survey assessed the extent to which participating GTAs perceived

their department and members of their department as supportive of good teaching. This

was addressed by five Likert-type scale items, as well as an open-ended item requesting

an example of a display of support for good teaching.

Teaching Support and Training

Information regarding an institution's primary teaching support structures

available to math GTAs was gathered through four sources. (1) During initial phone

contacts, general descriptions of training available were solicited from the available

department member. (2) Items 11, 11a and 14a on the Teaching Assistant Survey address

training participation and departmental displays of support; GTA responses to these items were transcribed and analyzed for trends by institution. (3) Websites and internet resources of participating departments/universities were investigated in an effort to obtain information regarding training and teaching support offered to graduate teaching assistants. (4) In March, 2006, phone interviews were conducted with each participating university math department's chair or head in an effort to verify and elaborate on any of the evidence of teaching support obtained from resources (1), (2), and (3). The department chair/head was assumed to be knowledgeable about availability of GTA training, whether departmental or university teaching awards are offered, the existence of a faculty teaching resource center or an office for improvement of instruction, and whether other support structures are in place at the institution or specifically in the department. Each interview was conducted with a semi-structured series of questions, based on information obtained from the literature and resources (1), (2), and (3) for that particular institution. For a copy of these questions, please see Appendix C.

For the purposes of this study, the term "GTA Training" referred to activities designed to foster teaching abilities and increase the quality of instruction delivered by GTAs. Those institutions offering departmental or university GTA Training of a span of at least five days were classified as with training. This was intended to exclude regularly scheduled staff meetings with the GTA's basic course supervisor. Those institutions offering no GTA training, or offering only GTA trainings with span and duration of less than five days were classified as without training. These definitions, as implied in the literature (e.g., Garet et al., 1999; Loucks-Horsley et al., 1998), were not easily applied to

the participating institutions. In an effort to pay careful attention to consistent classification, the four sources outlined above were also used to classify institutions as with or without training. There were often inconsistencies between the initial contact response (resource 1) and GTA survey responses (resource 2), and in some cases inconsistencies within groups of GTAs, at a particular institution. References to university or departmental training or orientation were found on fewer than half of participating institutions' and departments' websites (resource 3). Phone interviews with the department chair or head (resource 4) proved in most cases to be a definitive description of any training offered to GTAs. Interviews were conducted with 22 out of 29 departments' chair or head.

Although the initial research questions, based on a particular definition of GTA Training, dictated analyses with four groups of participating institutions (R/E with training, R/E without training, R/I with training, R/I without training), based on data obtained from the four sources outlined in the section above, analyses were also run classifying participants into six groups. Descriptions of training offered by GTAs and department chairs/heads varied greatly from institution to institution. These additional analyses were included in an effort to recognize and investigate differences between institutions offering no training whatsoever and those offering some type of training or orientation, even if that is minimal and does not span five or more days. The six groups are: R/E with no training, R/E with some training (less than 5 days), R/E with training (span of five days or more), R/I with no training, R/I with some training (less than 5 days), R/I with training (span of five days or more).

Variables

The first dependent variable for this study was mathematics GTA attitudes

towards teaching as measured by the four items in Survey Question 13:

> For each of the following statements, please indicate the extent to which
> the statement describes your college teaching *this term*, where: **1=never,**
> **2=rarely, 3=about half the time, 4=usually, 5=always.**
> a) I look forward to time spent with students in class.
> b) I have had students tell me that they appreciate my enthusiasm for
>   math.
> c) I seek ways to improve as an instructor.
> d) I would prefer a research assistantship to my teaching assistantship.

The researcher averaged the four items in Survey Question 13 into a single Attitude Scale

(Cronbach's α = .568), with values ranging from one to five and higher scale scores

indicating a more positive GTA attitude toward teaching. Eliminating the recoded 13d

from the Attitude Scale raises the internal reliability of the scale slightly, to α = .582; this

points toward analyses using both a 4-item Attitude Scale and a Modified (3-item)

Attitude Scale.

The second dependent variable was math GTA perceptions of support for good

teaching as measured by the five items in Survey Question 14:

> Based on your experiences in *this* mathematics department, please answer
> the following questions to the best of your knowledge. The scale is as
> follows: **1=not at all supportive, 3=somewhat supportive, 5=strongly**
> **supportive**; if you have no opinion or the item is not applicable to you,
> please mark the box.
> • How supportive of good teaching is your major professor/ advisor?
> • How supportive of good teaching is your *current* course supervisor?
> • How supportive of good teaching are most TAs in your math
>   department?
> • How supportive of good teaching are most faculty in your department?
> • How supportive of good teaching is your math department?

The five items in Survey Question 14 were combined into a single Support Scale (Cronbach's α = .818), with values ranging from one to five and higher scale scores indicating a more positive GTA perception of the support for good teaching in their department.

The two independent variables for the current study are Carnegie Classification (R/E or R/I) as indicated by the Carnegie Foundation for the Advancement of Teaching (2001), and the participating GTAs' mathematics department's availability of GTA Training. Training was analyzed using both a 2-item Training classification and a 3-item Training classification as outlined above.

Data Collection

Upon completion of the list of randomly selected colleges and universities, the researcher contacted each of the 40 mathematics departments in an effort to obtain the approximate number of GTAs employed by that mathematics department, and information about the structure of the university calendar; a general question about the availability of training for GTAs was also asked. For those institutions on a semester calendar, survey packets were mailed during the first week of October; for those institutions on a quarter system, survey packets were mailed during the first week of November. This was intended to allow all participating GTAs to have had approximately at least four weeks of experience as a GTA and as a member of their mathematics department in the fall of 2005 before completing the Teaching Assistant Survey. All survey data were collected by December 30, 2005.

Due to the fact that a typical department contact was made with an administrative assistant or faculty member, an introductory cover letter was sent to the math department chair/head with a copy also sent to the contact person. According to the number of graduate teaching assistants employed by a participating department in Fall, 2005, a packet of surveys was mailed to the attention of the department contact person. The packet also contained the cover letter requesting that the enclosed surveys be distributed to every GTA who had at least partial responsibility for the material taught in an undergraduate level mathematics, statistics, or mathematics education course. Attached to each individual survey was an additional cover letter addressed to math GTAs explaining their rights as human subjects, and requesting that they complete the survey and return it in the attached postage paid return envelope. For sample copies of the cover letters used, please see Appendix D.

<div align="center">Data Analysis</div>

Upon receipt of surveys, all data were entered into an SPSS spreadsheet. Twenty-five of the 252 returned surveys were randomly selected and data entry was found to be accurate on all twenty-five. Other columns were then added to the spreadsheet to indicate Carnegie Classification of the institution, researcher designation of availability of training, and a re-coding of survey item 13d, which was negatively worded on the Teaching Assistant Survey. Additional columns were added for the Attitude Scales and Support Scale.

Research questions 1 and 2 were answered using factorial analysis of variance (ANOVA). This was in order to analyze the effects of Carnegie Classification and GTA training on GTA attitudes toward teaching (question 1) and on GTA perceptions of the support for good teaching in their department (question 2). Research question 3 was answered using bivariate correlation, to investigate relationships between mathematics GTA perceptions of the support for good teaching in their department and mathematics GTA attitude toward teaching. Research question 4 was answered in summary form, using qualitative data from four sources: (1) input from the initial department phone contacts, (2) GTA survey responses, (3) website and internet searches, and (4) semi-structured phone interviews with department chairs/heads. The analyses performed for questions 1, 2, and 3 were all conducted as two-tailed tests in an effort to examine relationships simply. All quantitative results are reported using $p=.05$ as the desired significance level due to its wide acceptance in the educational research community (George & Mallery, 2003; Gliner & Morgan, 2000). Results of the outlined analyses are reported in Chapter 4, and a discussion of the results is presented in Chapter 5.

Assumptions and Limitations

The validity of the research conducted here was based on the assumption that the survey instrument being used was an accurate measure of GTA attitude toward teaching and of GTA perceptions of the support for good teaching in their department. It must also be assumed that mathematics GTA participants and all other university contacts provided the researcher with honest and accurate information to the best of their abilities. Along

the same lines, it was assumed that any information obtained from university and mathematics department webpages was current and accurate at the time of researcher access.

Possible limitations of the current study included the fact that data about teaching attitudes were coming from only one source: self-reported data which was dependent on the cooperation of participating GTAs. Non-response by mathematics GTAs, and non-cooperation of mathematics departments also limited the amount of data collected for this study, and thus the generalizability of the results. An additional limitation involved the piloting of the Teaching Assistant Survey on mathematics graduate teaching assistants at a Research University—Intensive, whereas approximately 56% of the participating graduate teaching assistants were drawn from the pool of institutions classified as Research Universities—Extensive. A final limitation, which will be addressed further in the discussion section, is the lack of consensus among university faculty and GTAs as to a definition of GTA training.

<div align="center">Summary</div>

Data were collected for the current study through use of a researcher-developed survey completed and returned by a randomly selected cluster sample of 252 GTAs in the math departments at 16 Research Universities—Extensive and 13 Research Universities—Intensive from across the United States. The survey data gathered included information about GTA demographics, GTA attitudes toward teaching, and GTA perceptions of the support for good teaching in their department. Data regarding the

primary teaching support structures available to math GTAs at participating universities were compiled from GTA survey responses, institutional website searches conducted by the researcher, and semi-structured interviews with math department chairs/heads. Surveys were distributed in October and November of 2005; all survey data were collected by December 30, 2005. Internet searches and phone interviews were conducted throughout Spring, 2006.

The next chapter presents statistical results of the current study, organized in the order of the research questions. Chapter 5 contains a discussion of those results and their implications.

CHAPTER 4

RESULTS

This chapter details data and results collected in an effort to answer the four research questions for this study. First, background information on participating mathematics GTAs and participating institutions are presented. Then, statistical and qualitative results are presented in an order corresponding to the research questions. The discussion of these results and their implications can be found in Chapter 5.

Participants

Participating Mathematics GTAs

Items one through 12a on the Teaching Assistant Survey addressed demographic information about participants. Responses to these items helped to provide a general description of the 252 mathematics graduate teaching assistants who participated in this study. Respondents were 65.7% male, 34.3% female. The doctorate was the more common degree which participants were working towards (63.5%), and 35.7% of respondents were working towards a masters degree. International students made up 29.8% of the sample.

In an effort to compare these demographics to national data, the researcher accessed the IPEDS Peer Analysis System through the National Center for Educational Statistics online database (2005). A comparison group was created using Carnegie Classification as the variable for group creation, and included 258 institutions classified as R/E or R/I. Due to the nature of variable selection, the information that follows refers

to students completing graduate degrees in the 2004-2005 school year within the program identified as "mathematics and statistics". Overall, 60.96% of graduates in mathematics and statistics were male and 39.04% were female. Among these students, 23.81% completed a doctorate, and 76.19% completed a masters. "Non-resident alien" students comprised 46.06% of the graduates in mathematics and statistics.

Regarding the sample of respondents for the current study, mathematics was selected as their program of study by 80.6% of participating GTAs; 14.3% of GTAs selected statistics; 2.8% chose math education; and 1.2% indicated "other" as their program of study. A question regarding terms as a mathematics GTA, including summers, quarters, semesters, and the current Fall, 2005 term yielded a range of one to 18 terms. The most common response was one term (23.8%), and the next most frequent reply was three terms (12.7%). Question 11 asked, "Have you participated in TA training of any type?" and 86.9% of participants answered "yes". A final item of interest assessed the general level of teaching responsibility GTAs held in their department. The four categories were (a) "I work in the math learning center, tutor students, and/or grade other instructors' students' work" (7.9%); (b) "I lead a recitation or homework session only, and do not plan lectures" (25%); (c) "I plan class lectures, I write and grade quizzes, but I am not responsible for creating the course syllabus" (33.7%); (d) "I plan class lectures; I have primary control of creating the syllabus; I write and grade exams" (27.4%).

Participating Institutions

Table 1 is a general description of the 29 institutions whose mathematics departments and graduate teaching assistants participated in the data collection process.

Carnegie Classification is based on the 2000 Carnegie Classifications by the Carnegie

Foundation for the Advancement of Teaching (2001) where R/E indicates Research

Universities—Extensive and R/I indicates Research Universities—Intensive. Geographic

regions are divisions of the country as outlined by the U.S. Census Bureau (n.d.); total

student enrollments were obtained from the Carnegie Foundation for the Advancement of

Teaching (2005) and include undergraduate and graduate students. The final two columns

show an institution's designation of availability of training based on data collected about

the institution and the mathematics department. As described in Chapter 3 two scales

were used, the first a two-item scale distinguishing only between a span of less than five

days (without training) versus five days or more (with training). The second scale has

three items, allowing for classifications of no training, some training (less than five days),

and with training (five days or more).

Table 1

General Description of Participating Institutions

School number	Carnegie Classification	Region	Total enrollment	Training	
				2-item	3-item
1	R/E	New England	22,932	without	some
2	R/E	Mid-Atlantic	4,234	without	some
3	R/E	W.S. Central	17,269	without	some
4	R/E	W.S. Central	25,297	without	some
5	R/E	Mid-Atlantic	8,329	without	some

(Table 1 continued)

School number	Carnegie Classification	Region	Total enrollment	Training	
				2-item	3-item
6	R/E	Pacific	24,663	with	with
7	R/E	Pacific	32,160	without	some
8	R/E	Mountain	13,207	without	some
9	R/E	Mountain	32,362	with	with
10	R/E	Mid-Atlantic	19,518	without	some
11	R/E	Mid-Atlantic	21,648	with	with
12	R/E	Pacific	23,241	without	some
13	R/E	Mid-Atlantic	13,860	without	some
14	R/I	Mountain	27,339	without	none
15	R/I	Mountain	1,826	without	some
16	R/I	W.N. Central	15,498	without	none
17	R/I	E.N. Central	18,989	with	with
18	R/I	E.S. Central	8,531	without	some
19	R/I	S. Atlantic	15,329	without	some
20	R/I	S. Atlantic	4,683	without	some
21	R/I	Pacific	23,444	with	with
22	R/I	E.N. Central	21,598	without	some
23	R/I	E.N. Central	17,161	with	with

School	Carnegie		Total	Training	
number	Classification	Region	enrollment	2-item	3-item
24	R/I	Mountain	13,802	without	none
25	R/I	E.N. Central	15,985	without	some
26	R/I	E.N. Central	27,683	without	some
27	R/I	W.N. Central	14,256	without	some
28	R/I	E.N. Central	16,902	without	some
29	R/I	S. Atlantic	11,852	with	with

Research Questions

Research Question 1

Are there differences between the four groups of universities (R/E with training, R/E without training, R/I with training, R/I without training) in regard to math GTAs' perceptions of the support for good teaching in their department?

A 2x2 factorial analysis of variance was conducted to evaluate the relationship of Carnegie Classification and GTA Training to the Support Scale. The means and standard deviations for GTAs' perceptions of support as a function of university group are presented in Table 2. The Support Scale ranges from one to five, with higher scores indicating a more positive GTA perception of support for good teaching.

Table 2

Means and Standard Deviations for Perceptions of Support (2-item Training)

Carnegie Classification	Training (2-item)	n	Mean	*SD*
Research Extensive	without	94	3.69	.80
	with	46	3.44	.84
Research Intensive	without	67	3.98	.79
	with	41	3.83	.77

The ANOVA indicated that the overall model was significant, $F(3, 244) = 4.47$, $p = .004$, partial $\eta^2 = .05$. This shows that a significant portion of the variance in GTA perceptions of support for good teaching can be explained by examining Carnegie Classification, availability of training, and the relationship of these two independent variables. However no significant interaction between Carnegie Classification and availability of training was found, $F(1, 244) = .17$, $p = .68$, partial $\eta^2 = .001$. This means that the effects of availability of training on GTA perceptions of support for good teaching are the same whether the GTAs are at R/E or R/I institutions. Significant main effects were found for Carnegie Classification, $F(1, 244) = 10.15$, $p = .002$, partial $\eta^2 = .04$. This means that controlling for the level of training offered, mathematics GTAs at R/I Universities reported higher mean levels of perceived support for good teaching than mathematics GTAs at R/E Universities. Main effects for availability of training were not

significant, $F(1, 244) = 3.41$, $p = .07$, partial $\eta^2 = .01$. This shows that controlling for an institution's Carnegie Classification, there were not significant differences in GTA perceptions of support for good teaching in their departments based on whether or not training was available to them.

In an effort to recognize and investigate differences between institutions offering no training whatsoever and those offering some type of GTA training or orientation, even if that is minimal and does not span five or more days, the researcher repeated the above ANOVA using a 3-item classification of availability of training. The means and standard deviations for GTAs' perceptions of support for good teaching as a function of university group are reported in Table 3.

Table 3

Means and Standard Deviations for Perceptions of Support (3-item Training)

Carnegie Classification	Training (3-item)	n	Mean	*SD*
Research Extensive	none	0	—	—
	some	94	3.69	.80
	with	46	3.44	.84
Research Intensive	none	12	3.40	.85
	some	55	4.11	.73
	with	41	3.83	.77

This 2x3 ANOVA indicated that the overall model was significant, $F(4, 243)$ = 5.47, p = .000, partial η^2 = .08. This indicates that a significant portion of the variance in GTA perceptions of support for good teaching can be explained by examining Carnegie Classification, availability of training (3-item scale), and the relationship of these two independent variables. However, no significant interaction between Carnegie Classification and availability of training using a 3-item scale was found, $F(1, 243)$ = .04, p = .85, partial η^2 = .000. This shows that the effects of the availability of training on GTA perceptions of support for good teaching are the same whether the GTAs are at R/E or R/I institutions. Significant main effects were found for availability of training, $F(2, 243)$ = 5.97, p = .003, partial η^2 = .05, indicating that controlling for an institution's Carnegie Classification, those GTAs receiving some training reported a higher mean level of perceptions of support for good teaching than those receiving no training or a high amount of training. Post-hoc tests were conducted to evaluate pairwise differences among these adjusted means; the Tukey HSD indicated no significant differences between levels of training offered to mathematics GTAs. Significant main effects were found for Carnegie Classification, $F(1, 243)$ = 14.09, p = .000, partial η^2 = .06, indicating that controlling for level of training offered, GTAs in mathematics departments at R/I Universities reported a higher mean level of perceptions of support than did GTAs in mathematics departments at R/E Universities.

Research Question 2

Are there differences between the four groups of universities (R/E with training, R/E without training, R/I with training, R/I without training) in regard to math GTAs' attitudes toward teaching?

A 2x2 factorial analysis of variance was conducted to evaluate the relationship of Carnegie Classification and GTA Training to the Attitude Scale. The means and standard deviations for GTAs' attitude as a function of university group are presented in Table 4. The 4-item Attitude Scale includes all items from survey question 13 and responses range from one to five, with higher scores indicating a more positive GTA attitude toward teaching.

This ANOVA indicated that the overall model was significant, $F(3, 244) = 3.04$, $p = .03$, partial $\eta^2 = .04$. This shows that a significant portion of the variance in GTA attitudes toward teaching can be explained by examining Carnegie Classification, availability of training, and the relationship of these two independent variables. However, no significant interaction between Carnegie Classification and availability of training was found, $F(1, 244) = .05$, $p = .83$, partial $\eta^2 = .000$. This is a sign that the effects of the availability of training on GTA attitudes toward teaching are the same whether the GTAs are at R/E or R/I institutions. Significant main effects were found for Carnegie Classification, $F(1, 244) = 5.60$, $p = .02$, partial $\eta^2 = .02$. This indicates that controlling for availability of GTA training, mathematics GTAs at R/I Universities reported more positive attitudes towards teaching than their counterparts at R/E Universities. Main effects for availability of training were not significant, $F(1, 244) = 3.70$, $p = .06$, partial

$\eta^2 = .02$. This shows that controlling for an institution's Carnegie Classification, there were not significant differences in GTA attitudes toward teaching based on whether or not training was available to them.

Table 4

Means and Standard Deviations for Attitude (2-item Training)

Carnegie Classification	Training (2-item)	n	Mean	*SD*
Research Extensive	without	95	3.65	.79
	with	45	3.43	.76
Research Intensive	without	67	3.87	.73
	with	41	3.70	.70

An additional 2x3 factorial ANOVA was run using the 3-item Training scale. Means and standard deviations for attitudes as a function of university group are presented in Table 5. This ANOVA indicated that the overall model was significant, $F(4, 243) = 2.47$, $p = .045$, partial $\eta^2 = .04$, showing that a significant portion of the variance in GTA attitudes toward teaching can be explained by examining Carnegie Classification, availability of training (3-item scale), and the relationship of these two independent variables. No significant interaction between Carnegie Classification and availability of training was found, $F(1, 243) = .15$, $p = .70$, partial $\eta^2 = .001$, indicating that the effects of the availability of training on GTA attitudes toward teaching are the same whether the

GTAs are at R/E or R/I institutions. Significant main effects were found for Carnegie Classification, $F(1, 243) = 4.55$, $p = .03$, partial $\eta^2 = .02$. This shows that controlling for availability of GTA training, math GTAs at R/I Universities reported more positive attitudes towards teaching than math GTAs at R/E Universities. Main effects for availability of training were not significant, $F(1, 243) = 2.09$, $p = .13$, partial $\eta^2 = .02$. This indicates that controlling for an institution's Carnegie Classification, there were not significant differences in GTA attitudes toward teaching based on the type of training available to them (none, some, high levels of training).

Table 5

Means and Standard Deviations for Attitude (3-item Training)

Carnegie Classification	Training (3-item)	n	Mean	*SD*
Research Extensive	none	0	—	—
	some	95	3.65	.79
	with	45	3.43	.76
Research Intensive	none	12	4.04	.73
	some	55	3.83	.73
	with	41	3.70	.70

Exclusion of survey question 13d raised the internal reliability of the Attitude Scale slightly from (Cronbach's) α = .568 to α = .582. This may be a result of the fact

that this item was negatively worded on the original survey. With this in mind, the above

two analyses of variance were again run using a Modified Attitude Scale. Table 6 shows

the means and standard deviations for GTA attitudes toward teaching as a function of

university group, using a 2-item Training scale.

Table 6

Means and Standard Deviations for Modified Attitude Scale (2-item Training)

Carnegie Classification	Training (2-item)	n	Mean	SD
Research Extensive	without	95	3.79	.78
	with	45	3.64	.82
Research Intensive	without	67	3.99	.69
	with	41	3.75	.84

This 2x2 ANOVA indicated that the overall model was not significant, $F(3, 244)$

$= 2.01$, $p = .11$, partial $\eta^2 = .02$, showing that examining Carnegie Classification,

availability of training, and the relationship between these two independent variables

does not explain a significant portion of the variance in GTA attitudes toward teaching

(Modified Attitude Scale). Also, no significant interaction between Carnegie

Classification and availability of training existed, $F(1, 244) = .15$, $p = .70$, partial $\eta^2 =$

.001, indicating that the effects of the availability of training on GTA attitudes toward

teaching (Modified Attitude Scale) were the same whether the GTAs are at R/E or R/I

institutions. Main effects for availability of training were not significant, $F(1, 244) =$

3.63, $p = .06$, partial $\eta^2 = .02$. This indicates that controlling for an institution's Carnegie

Classification, there were not significant differences in GTA attitudes toward teaching

based on whether or not training was available to them. Main effects for Carnegie

Classification were also not significant, $F(1, 244) = 2.12$, $p = .15$, partial $\eta^2 = .01$,

showing that controlling for the level of training offered, there were not significant

differences in mathematics GTA attitudes toward teaching based on the Carnegie

Classification of their institution.

Table 7 presents the means and standard deviations for the Modified Attitude

Scale as a function of university group, using a 3-item Training scale. This 2x3 ANOVA

indicated that the overall model was not significant, $F(4, 243) = 2.13$, $p = .08$, partial η^2

$= .03$, showing that examining Carnegie Classification, availability of training (3-item

scale), and the relationship between these two independent variables does not explain a

significant portion of the variance in GTA attitudes toward teaching. Also, no significant

interaction between Carnegie Classification and availability of training existed, $F(1, 243)$

$= .003$, $p = .95$, partial $\eta^2 = .000$, indicating that whether GTAs are at R/E or R/I

institutions, the effects of the availability of training (3-item scale) are the same.

However, main effects for availability of training were significant, $F(1, 243) = 3.06$, $p =$

.049, partial $\eta^2 = .03$. This shows that controlling for Carnegie Classification,

mathematics GTAs receiving no training whatsoever reported more positive attitudes

toward teaching than those GTAs receiving some or extensive training. Post-hoc tests

were conducted to evaluate pairwise differences among these adjusted means. The Tukey

HSD indicated significant differences between GTAs receiving no training and training

of a span of at least five days ($p = .03$), but no significant differences between GTAs

receiving some form of training and those receiving either no training or at least five days

of training. Main effects for Carnegie Classification were not significant, $F(1, 243) =$

$1.22, p = .27$, partial $\eta^2 = .01$. This shows that controlling for the availability of training

offered to GTAs (3-item scale), there were not significant differences in GTA attitudes

toward teaching based on the Carnegie Classification of their institution.

Table 7

Means and Standard Deviations for Modified Attitude Scale (3-item Training)

Carnegie Classification	Training (3-item)	n	Mean	*SD*
Research Extensive	none	0	—	—
	some	95	3.79	.78
	with	45	3.64	.82
Research Intensive	none	12	4.31	.66
	some	55	3.92	.68
	with	41	3.75	.84

Research Question 3:

Is there a correlation between mathematics GTA perceptions of the support for good

teaching in their department and mathematics GTA attitudes toward teaching?

A bivariate correlation analysis was conducted to evaluate the relationship

between mathematics GTA perceptions of the support for good teaching in their

department and mathematics GTA attitudes toward teaching. Using the complete Attitude

Scale (4-item) and the Support Scale, the Pearson Correlation coefficient was $r = .19$,

which is significant at $p = .003$. Similarly, adjusting the Attitude Scale to eliminate

survey question 13d (using the Modified Attitude Scale), and relating those responses to

the Support Scale, the Pearson Correlation coefficient was $r = .20$, which is also

significant at $p = .001$. This indicates that using both the original and the Modified

Attitude Scales, there exists a weak positive correlation between mathematics GTA

perceptions of the support for good teaching in their department and GTA attitudes

toward teaching. A more positive GTA perception of support for good teaching can be

associated with a more positive GTA attitude toward teaching.

Research Question 4

What are the primary teaching support structures available to math GTAs at

participating universities in the four groups (R/E with training, R/E without training, R/I

with training, R/I without training)?

Qualitative data from four sources were collected to answer Research Question 4.

Results are presented here in summary format, largely focusing on the responses to semi-

structured phone interviews with department chairs/heads assuming that they were the

persons most knowledgeable about teaching support structures available to math GTAs at

their respective institutions. These semi-structured interviews were conducted with 22

chairs/heads out of 29 participating departments, and in the remaining seven departments,

data from the Teaching Assistant Survey, online resources, and the initial phone contact person were considered.

It is important to note differing definitions within certain categories of support. Regarding existence of a faculty teaching resource center or office for improvement of instruction on campus, the researcher was referring to an office whose general purpose is to promote good teaching at universities through use of media resources and workshops or seminars. Roles and names of these centers varied from campus to campus, and existence of what will here be designated as a Center for Teaching and Learning (CTL) on a campus was linked to a mathematics department in only nine out of 22 interviews. These connections between the CTL and math department varied and included help with orientation, money for GTA stipends, and GTAs being invited to CTL workshops. Similarly, interpretations and usage of weekly course-specific meetings for GTAs varied by department. In one department, these meetings are considered a for-credit seminar that is required of GTAs each semester. In 15 of 22 contacted schools, course-specific meetings were mentioned, and in 12 of these 15 the course meetings were not required or regular, but instead varied greatly in frequency and content from course to course, supervisor to supervisor.

R/E With Training. Three participating departments were classified as R/E With Training (Schools 6, 9, and 11), and interview data from two department chairs/heads were obtained. A CTL was available at all three institutions. Two departments required GTA attendance at a teaching seminar offered across the course of a semester, and one department required attendance at a teaching seminar offered across the course of a

school year. Teaching awards were offered for GTAs by two departments and faculty teaching awards were offered at the university level for the same two schools.

At School 6, an additional support mechanism for good teaching is a student-run organization which surveys undergraduates at the end of each term and publishes information about faculty and GTAs. At School 9 the department head described a strong informal mentoring system among graduate students as an additional support structure.

R/E Without Training. Ten participating departments were classified as R/E Without Training (Schools 1, 2, 3, 4, 5, 7, 8, 10, 12, 13), and data from eight of these department chairs/heads were collected. Either through the department chair or an internet resource, seven of the ten departments referred to availability of a CTL on campus. All ten departments referred to a brief GTA training before classes began, with five of the ten indicating that the primary focus is orientation. Five of the eight department chairs/heads replied that course-specific meetings do take place, but in only two of these departments were the meetings regular or required. GTA teaching awards are offered by five of these departments; six of the associated colleges offer GTA teaching awards; and two universities offer GTA teaching awards.

At School 2, GTAs are observed every semester by full-time faculty and given feedback on their teaching. The department chair at School 5 indicated that the department displays an "intangible but potent" support of the university's undergraduate teaching mission. At School 10, the math department offers a biweekly teaching seminar which is organized by graduate students. An additional support structure offered at

School 12 is "Preparing the Future Professoriate", a course organized by the graduate school.

R/I With Training. Of the participating departments, four were classified as R/I With Training (Schools 17, 21, 23, and 29); phone interviews were conducted with all four department chairs/heads. Three out of four of these departments offer credit hours for their GTA teaching training seminar/course. Two departments require training before classes begin, and two require it across the school year. Three of the four institutions have a CTL on campus. Three of these departments offer GTA teaching awards; one of the associated colleges offers GTA teaching awards; at only one school are GTA teaching awards given at the university level.

At School 17, the required summer teacher training has been found to help not only with teaching, but also to build a cohort and support network among participating GTAs. A teaching support structure offered at School 23 is classroom visits by the TA Teaching Coordinator at least twice each semester. In that same department, there is a policy to try to provide financial support to students wanting to attend workshops or conferences which would better their teaching. At School 29, mentoring takes place between senior and junior faculty, and the graduate director makes an effort to observe GTAs teaching.

R/I Without Training. Twelve of the participating departments were classified as R/I without training (Schools 14, 15, 16, 18, 19, 20, 22, 24, 25, 26, 27, 28). Interview data were obtained from eight of these 12 department chairs/heads. According to

department chairs/heads and online research, ten of these twelve institutions have a CTL on campus. Ten of the twelve departments require a brief orientation-style training prior to teaching; two departments offer no training at all. Only two of these twelve departments indicate offering a teaching award for GTAs; one associated college offers GTA teaching awards; and only one department chair/head was aware of a university level teaching award for GTAs.

Within this group of departments, there were two department chairs/heads who offered additional examples of support structures available to math GTAs. At School 25, faculty mentors are assigned to each GTA for guidance, separate from the course supervisors. At School 26, faculty visit courses to observe twice each semester; additionally, there is a requirement of doctoral students to complete two courses in mathematics education and research in college math.

GTA Descriptions of Support. While creating the Teaching Assistant Survey, the researcher recognized that the interpretation of being "strongly supportive of good teaching" could vary greatly from participant to participant. For this reason, clarification was sought through examples of displays of support from those who rated any department member (advisor, course supervisor, other GTAs, department faculty, the department in general) as 4 or 5 on the Likert-type scale where 1 was "not at all supportive" of good teaching and 5 was "strongly supportive" of good teaching. One hundred sixty-one of the 252 participants replied to question 14a. Analysis of the results to this survey item was conducted using standard qualitative analysis methods (Patton, 2002). In addition to their use in describing teaching support structures available to math

GTAs, the classification of the GTA examples contributes to the discussion of the results to research questions 1, 2, and 3 in Chapter 5.

Responses to this final survey item were typed into a Microsoft Word document, and then coded by cutting each quote into specific statements or examples, yielding 240 statements or examples. On two occasions, approximately ten days apart, the researcher classified these examples. The coding initially began with forms of support outlined by the literature as commonly provided to graduate teaching assistants (e.g., Buerkel-Rothfuss & Gray, 1989). As the process continued, categories were expanded to include non-literature examples as themes emerged among the GTA statements. These two categories were labeled tangible (ideas from the literature) and intangible (ideas which emerged from the GTA responses).

The two main categories of "tangible" and "intangible" were then coded into axial themes, which are listed here with a representative sample GTA quote for each subcategory. Tangible displays of support included GTA training or seminars ("*Our math department requires us to take classes to improve our teaching."*); textbooks and supplies ("*Willing to provide space and materials when I ask for outside-class time help for students.*"); observations and feedback ("*My course supervisor watched and critiqued my teaching during a class to improve my teaching skills.*"); and teaching awards and recognition ("*The department gave me a financial bonus upon reviewing the evaluation forms from the students.*"). Intangible displays of support included modeling of good teaching ("*My major advisor attends many faculty workshops that focus on teaching techniques.*"); sharing teaching ideas and tips ("*All TAs, professors and faculty are*

extremely willing to give ideas on how to run class, share [Latex] files, and share what has worked for them and what has not."); availability for assistance ("*You can stop by the professor's office, they will help you. Almost every TA has office hours, they are also accessible by email.*"); teaching as conversation ("*Any time I pass a math instructor/staff member, they will say 'Hello, how's teaching?' 'Keep up the good work!' That is very encouraging to me.*"); and a general departmental emphasis on teaching ("*A specific example is hard to cite since almost the entire department stresses and encourages teaching.*").

Although it was intended that any GTA who responded that they perceive high levels of support include an example and thus be included in this study, that was not the case. Of the 252 GTAs who returned completed surveys, 161 responded to the open-ended final question. This includes four GTAs who made somewhat negative comments about their departments ("*5 on surface, 3 is generous in practice*"; "*Sorry. These avenues of communication are pretty much non-existent.*"). There were also 45 GTAs who did not provide an example of a display of support even though they had rated at least one department member's support of good teaching as a 4 or 5 (where 5 was "strongly supportive" of good teaching).

Overall, 67.9% of GTA quotes were classified by the researcher as intangible examples of displays of support, and 30.4% of GTA examples of displays of support were classified as tangible. Regarding Carnegie Classification and availability of training, there were not observationally significant differences among the four groups. Overall, 29.3% of examples of displays of support for good teaching provided by GTAs at

Research Universities—Extensive were categorized as tangible and 68.4% as intangible.

At Research Universities—Intensive, 31.8% of GTA quotes regarding displays of support

for good teaching were classified as tangible, and 67.3% as intangible. Similar

proportions existed for the four groups of R/E with training, R/E without training, R/I

with training, R/I without training.

When investigating the main category of example (tangible or intangible) as it

compared to GTA demographics, the distribution of quotes was also remarkably uniform.

Approximately one-third of both male and female comments were tangible, with two-

thirds of each group's quotes being classified as intangible. Again, approximately one-

third of both international and national GTAs' examples of displays of support were

tangible, with two-thirds of each group's quotes being classified as intangible. In terms of

major or program of study, for each of Mathematics, Math Education, Statistics, and

Other, approximately 30% of responses were categorized as tangible and 70% were

considered intangible. Likewise, whether GTAs were working on a doctorate or masters

degree, roughly one-third of responses were tangible displays and two-thirds were

intangible.

In general, although many similar teaching support structures are available at

participating institutions, the extent to which they are offered varies greatly from

department to department. The most notable distinction among schools was the initial

description of training used in this study to classify the participating institutions into four

groups (R/E with training, R/E without training, R/I with training, R/I without training).

The seven schools classified as "with training" all offered training extending across at

least five days, and the remaining 22 schools offer trainings better described as orientations in most cases. Examining GTA examples of support leads to the conclusion that intangible support is the most common type of support perceived by GTAs in math departments at all four types of institution (R/E with training, R/E without training, R/I with training, R/I without training). The GTA examples of displays of support provided on survey question 14a were far more descriptive and informative than any internet or department chair data.

Summary

This chapter has provided a detailed report of results of the current study. Regarding research question 1, controlling for the level of training offered, mathematics GTAs at R/I Universities reported higher mean levels of perceived support for good teaching than mathematics GTAs at R/E Universities. In summary of research question 2, controlling for availability of GTA training, mathematics GTAs at R/I Universities reported more positive attitudes towards teaching than their counterparts at R/E Universities. Additionally, controlling for Carnegie Classification, mathematics GTAs receiving no training whatsoever reported more positive attitudes toward teaching than those GTAs receiving some or extensive training. Data used to answer research question 3 indicate a weak positive correlation between mathematics GTA perceptions of the support for good teaching in their department and GTA attitudes toward teaching. Research question 4 was answered in summary form using qualitative data and, in

general, teaching support structures provided to mathematics GTAs varied greatly from institution to institution.

The final chapter of this dissertation follows, and presents a summary of the study and results. Also included are implications for both research and practice based on the results of this study.

CHAPTER 5

CONCLUSIONS

Graduate teaching assistants (GTAs) are responsible for a noteworthy amount of undergraduate student credit hours at most post-secondary institutions across the United States. Any efforts made to improve the quality of teaching provided by GTAs potentially have the long term benefits of not only improving undergraduate education in general, but also establishing a commitment to professional development in the next generation of faculty (Barrington, 2001; Graff, 1994). The current study contributes to the overall understanding of graduate teaching assistants by specifically investigating mathematics graduate teaching assistants.

The population of interest for this study was graduate teaching assistants in mathematics departments at Research Universities—Extensive and Intensive (Carnegie Foundation, 2001). A random stratified cluster sample process was used to identify mathematics departments at 16 Research Universities—Extensive (R/E) and 13 Research Universities—Intensive (R/I) from across the United States which agreed to participate fully in the study. Responses to the Teaching Assistant Survey were received from 252 mathematics graduate teaching assistants (30.66% response rate) at these 29 institutions.

This study addressed differences between the four groups of universities (R/E with training, R/E without training, R/I with training, R/I without training) in regard to math GTAs' perceptions of the support for good teaching in their department and in regard to math GTAs' attitudes toward teaching. Additionally, correlations between mathematics GTA perceptions of the support for good teaching in their department and

mathematics GTA attitudes toward teaching were examined. Finally, through use of the Teaching Assistant Survey, and additional data collected through internet searches of university and math department websites, and semi-structured phone interviews with participating department chairs/heads, a qualitative analysis of the primary teaching support structures available to math GTAs at participating universities in the four groups (R/E with training, R/E without training, R/I with training, R/I without training) was conducted.

Discussion of Results

The Impact of Carnegie Classification

The first key finding is that when controlling for the level of training offered, math GTAs at R/I Universities reported higher mean perceptions of support for teaching than math GTAs at R/E Universities; this was true using both the 2-item and 3-item Training Scales discussed in Chapter 4. This first finding supports the literature through GTA perceptions which indicated greater emphasis on teaching at R/I institutions than at R/E institutions. In general, throughout the literature on GTAs and university faculty, it is commonly noted that many universities and departments value research above teaching (e.g., Barrington, 2001; Blackburn, 1993; Grunwald & Peterson, 2003; McGivney-Burelle, et al., 2001). Boyer (1990) and DeFranco and McGivney-Burelle (2001) specifically discuss differences in the value placed on teaching as it relates to an institution's Carnegie Classification, stating that institutions with a higher commitment to research productivity (R/E) tend to place less emphasis on teaching, and institutions

which have slightly lower commitments to research productivity (R/I) will place more emphasis on teaching.

Additionally, when controlling for availability of GTA training, math GTAs at R/I Universities reported more positive attitudes toward teaching than their counterparts at R/E Universities (2-item and 3-item Training Scales). Much like the first result, there is a variety of literature which supports the idea that institutional messages about teaching versus research impact faculty and GTA practice (e.g., Blackburn, 1993; Graff, 1994). These institutional and departmental messages come in a variety of forms, including higher pay for research assistantships than for teaching assistantships, or research productivity being given more value than teaching proficiency in faculty tenure decisions. In 1989, Lumsden concluded that "if the TAs thought the department/university placed value on effective teaching they seemed to place value on effective teaching" (p. 81).

The attitudes of a university or department towards teaching are related to faculty and GTA attitudes toward teaching. Lumsden's (1989) research on biology graduate students points to a positive relationship between attitudes toward teaching and teaching performance. Looking at culture and future investigation of attitudes toward teaching can potentially contribute to the quality of GTA teaching performance.

According to LaCelle-Peterson (1993) the key to improving higher education in the U.S. is understanding individual and institutional commitments to teaching and the relationship between these commitments. Using both the original and Modified Attitude Scales, there exists a weak positive correlation between perceived departmental support for good teaching and GTA attitudes toward teaching. This third finding hints at a

relationship between GTA and math department commitments to teaching, and is supported by researchers and experts who have stated that what the university values, faculty and GTAs will also value (Blackburn, 1993; Graff, 1994; Lumsden, 1989; Smith, 1993).

The Impact of the Availability of Training

A somewhat unexpected outcome of the current study is that those math GTAs receiving some training reported a higher mean level of perceived support for teaching than those GTAs receiving no training or a high amount of training (3-item Training Scale). According to Belnap (2005) training is not necessarily as important as an actual support structure for mathematics GTAs, including colleagues (fellow GTAs), supervisors, and course resources. DeFranco and McGivney-Burelle (2001) also found that although training for GTAs has value, it is a relatively minor aspect of GTA enculturation to teaching. This can, in part, explain the significant differences in perceptions of support for good teaching between those GTAs receiving some training and those receiving high levels of training. On the Teaching Assistant Survey used for the present study, question 14a addressed differences in the interpretation of "supportive of good teaching" by requesting that GTAs provide an example of support for good teaching in their departments. Analysis of these examples (presented in Chapter 4) indicated that training is by no means the only way for a mathematics department to support good teaching among GTAs. In fact, after qualitative analysis, only 15% of the GTA examples of support in item 14a were related to training, meetings, or GTA seminars. The remaining 85% of examples of support provided by GTAs ranged from teaching

observations and feedback to the free sharing of ideas and resources among instructors. While it doesn't appear to be unusual for departments offering some training to be perceived as more supportive of good teaching than those offering no training, where is the discrepancy between those departments offering some training and high amounts of training? Perhaps schools offering high amounts of training limit their support for good teaching to training sessions and those departments offering some training make more day-to-day efforts to acknowledge the importance of teaching.

An even more surprising outcome of this study is that math GTAs receiving no training whatsoever reported more positive attitudes toward teaching than those GTAs receiving some or high levels of training (3-item Training Scale, Modified Attitude Scale). Post-hoc tests indicated significant differences in attitude between GTAs receiving no training and those receiving high levels of training, but no significant differences in attitude between those receiving no training and some training or some training and high amounts of training. This unanticipated finding does not indicate that eliminating training for mathematics GTAs will create more positive attitudes toward teaching. Instead, the data collected from GTAs here reveal that there are methods apart from training which academic departments can use to support good teaching among instructors. As described in the previous result, other studies have also found that training is only one way for a department or university to support GTAs and help foster positive attitudes toward teaching (Belnap, 2005; DeFranco & McGivney-Burelle, 2001). As cited by the GTAs surveyed here, in addition to training, tangible support for good teaching can also include supplies; observations and feedback; and awards and recognition.

Intangible support for GTAs can include modeling of good teaching; accessibility;

sharing teaching ideas; and a general departmental emphasis on teaching. The goal is "'to

create a culture of teaching, one in which the conversations, the priorities [and, I would

add, the rituals and kinship systems] of the department have teaching at their center'"

(Shulman, 1993, no page, brackets in original).

<div align="center">Limitations</div>

Although results presented here provide insight into mathematics departments and

GTAs across the country, the use of the Teaching Assistant Survey created limitations for

the current study. First, data about teaching attitudes were coming from only one source:

self-reported data which was dependent on the cooperation of participating GTAs. Non-

response by mathematics GTAs, and non-cooperation of mathematics departments also

limited the amount of data collected for this study, and thus the generalizability of the

results. The fact that participants may have self-selected contributes bias to the sample,

and thus affects the nature of the data reported here. In particular, a self-selection bias

introduces the possibility that participating GTAs were those who had strong positive or

negative attitudes towards teaching. The survey response rate of 30.66% adds to that

complication because although response rates ranged from 13.89% to 100% by

department, only in School 18 where 100% of surveys were returned is the bias of non-

response eliminated.

In the case of five institutions, a university official who agreed to distribute

surveys apparently did not follow through with that commitment; this limited the

potential sample of GTAs by approximately 100 participants. Because the Teaching

Assistant Survey was mailed to GTAs in care of their departments, the researcher had no

control over the environment in which surveys were completed. Perhaps some GTAs

discussed their survey responses with one another, and perhaps others were interrupted

by class schedules or office hours. An additional limitation involved the piloting of the

Teaching Assistant Survey on mathematics graduate teaching assistants at a Research

University—Intensive, whereas approximately 56% of the participating graduate teaching

assistants were drawn from the pool of institutions classified as Research Universities—

Extensive.

When reporting results using the Attitude Scale and Modified Attitude Scale, it is

important to remember that although the four survey items included all had re-test

reliability coefficients above $G = .80$, when combined they were not as strong as a Scale.

To say that a measurement is reliable, a coefficient between +.7 and +1.0 is expected

(Gliner & Morgan, 2000). The internal reliability for the Attitude Scale was Cronbach's α

= .568, and for the Modified Attitude Scale (which eliminated the negatively worded

13d), Cronbach's α = .582. The Support Scale has relatively high reliability (α = .818),

but in comparison, the lower reliability of the Attitude Scales limits the confidence in the

conclusions drawn for research questions 2 and 3.

The current study found that the types of training available to graduate teaching

assistants vary from university to university, which has been noted in the past by

researchers like Buerkel-Rothfuss & Gray (1989). Lack of consensus among university

faculty and GTAs as to a basic definition of GTA training makes research even more

difficult than the variety of types of training and support offered to GTAs. Similarly, Shannon, Twale and Moore (1998) have discussed the difficulties in assessing the effects of GTA training because of disagreement regarding a definition of training across, or even within disciplines. A limitation of this study is that the researcher was forced to utilize data from GTAs and math department chairs/heads that was often incongruous in order to classify each department as providing training or not based on a definition established from the literature. Without consensus on what training means, a subsequent study might classify these institutions differently.

Based primarily on work by Boyer (1990) and the Carnegie Foundation, this study assumed that significant differences would exist in GTA attitudes toward teaching and GTA perceptions of support for good teaching based on the Carnegie Classification (2001) of a GTA's institution. A limitation of this study involves using a university-level measure of research productivity and involvement (R/E vs. R/I) as a key independent variable when examining perceived departmental support and attitudes toward teaching in mathematics departments. Additionally, during the final stages of data collection, the Carnegie Foundation (2005) introduced a newer, intentionally more comprehensive, classification system for institutions of higher education.

Directions for Future Research

Re-Evaluating the Variables

The limitations and findings of this study lead to many opportunities for future work. With the newest Carnegie Classification system in place (2005), it would be

beneficial to conduct the same study again utilizing the newest university-level classifications. Do the most recent Carnegie Classification characteristics better predict math GTA attitudes toward teaching and perceptions of departmental support for good teaching than the 2001 version? In a similar fashion, a resource like the Delaware Study (2006) would allow for creation of an independent variable which addresses academic productivity and costs at the department level, rather than at the university level. Use of a different independent variable related to departmental research productivity has the potential to allow for exploration of math GTAs using a closer approximation of department culture than Carnegie Classification.

It is important that future researchers consider the possibility that the current four-item Attitude Scale could benefit from improvements. A more precise instrument could potentially measure attitudes toward teaching with more accuracy. Specifically, the negatively worded item "I would prefer a research assistantship to my teaching assistantship" may have unintentionally forced GTAs to make a decision about issues other than their love of teaching. The Attitude Scale used as a dependent variable had a slightly higher internal reliability without including this item, in part because it was negatively worded. Upon closer inspection, the item may have actually addressed something tangential to teaching attitude, and perhaps this is related to a departmental or university rewards system. There were three participating GTAs who replied to this item and made a specific note that their reasoning was not about lack of interest in teaching but about the monetary benefits of being a research assistant, or the necessity of having

work time for their dissertations. This indicates that this item may have (for at least some participants) addressed something different from simply their attitude toward teaching.

<u>What is Support?</u>

Future research is needed to address the issue of clarity of what is offered as support to GTAs and the consistency of what is reported. In seventeen schools GTAs consistently indicated having participated in training, but in only fifteen of these departments did the initial phone contact say that the department offered training of any sort. In the remaining twelve participating departments there were great discrepancies in reporting, like in School 13 where 43.8% of participants indicated they had participated in training, and 56.3% indicated they hadn't. In two of these schools, both the initial phone contact and the department chair/head described available training, but 50% or less of GTAs indicated having participated in training. This may indicate lack of communication about the goals of training sessions or meetings, or perhaps ineffectiveness of training sessions or meetings. In the case of School 29, although 100% of GTAs indicated they had participated in training of some type, their descriptions varied from "*15 minutes plus T.A. Exam*" and "*2-3 hrs. during the semester*" to "*several sessions during one week before classes started covering many topics*" and "*the TA training was in the beginning of semester and it lasted for 2 weeks.*" Possibly departments set aside time for training, but the GTAs question its helpfulness in their development as instructors so they don't consider it to be training.

In this study GTAs responded to an open-ended question about examples of departmental support whereas department chairs/heads responded to a semi-structured

series of questions, and in some cases there were great discrepancies. Given the opportunity, what factors would be related to GTAs and department officials recognizing comparable support structures in their departments? The department environment is perceived differently by different members, and a suggestion is for a future researcher to visit each department of interest and observe at least one training session. This standardized lens through which to make observations and classifications could eliminate discrepancies in descriptions of training type and availability.

Broadening the Scope

This study examined attitudes toward teaching as one aspect of teaching effectiveness. Perhaps in the future, any or all five of the researcher-defined categories of teaching effectiveness could be examined as they relate to institution type and availability of support and training for math GTAs. Professional development of GTAs is a relatively new topic for study, and it might prove interesting to research connections and discrepancies between support and professional development for K-12 teachers and for GTAs. Are there lessons to be learned about culture and support for all new teachers? Can insights gained about research vs. teaching emphasis at the university level be related to insights about content vs. pedagogy at various grade levels?

Although this study measured Carnegie Classification and availability of training as approximations of departmental culture, an interesting future study could explore the examples of support cited by the participating GTAs. The quantitative analyses conducted here show that Carnegie Classification explained a significant amount of the variance in math GTA attitudes towards teaching and perceptions of support. However,

the qualitative analysis of survey item 14a indicate that the construct of departmental

culture and the ways in which a department can support good teaching are far more

complex than anticipated. Perhaps in the future, a more thorough analysis of all members

of fewer departments could capture a clearer snapshot of what departmental culture is.

Although the results of this study provide useful insights into mathematics

graduate teaching assistants, the research conducted here can be expanded upon in a

variety of ways. Considering university staff professional development in general, what

types of support structures do faculty members notice which encourage their teaching?

Are these related to any of: university type, academic discipline, teaching experience,

availability of new faculty training? A broader sample of academic departments could

also be surveyed in order to investigate the possibility that discipline may be a more

indicative independent variable than Carnegie Classification. In addition to the diversity

of individual GTAs, the researcher suspects that department cultures about teaching vary

from discipline to discipline.

<center>Suggestions for Practice</center>

Institutional Messages about Teaching

The findings of this study are based upon data from math GTAs, but can

potentially extend to teaching assistants and new faculty in a variety of disciplines. In

addition to future research which can broaden the scope of the current study, individuals

at universities across the country can use results from this study to inform their work with

GTAs. For example consider the insights that can be gained from the GTA who

responded "always" to the statement "I would prefer a research assistantship to my teaching assistantship", and then made a note that "*this is not due to lack of interest in teaching, rather due to more money for less hours of work when you have a research assistantship. This is important when you're also a student working on a dissertation.*" Are there other (non-financial) institutional and departmental messages about teaching versus research which encourage shifts in the actions of even those GTAs who love teaching?

Considering the work of Tierney (1988), and his research on colleges and universities as cultures, departments would benefit from investigating GTA and faculty perceptions regarding: "How do new members become socialized?" and "What do we need to know to survive in this organization?" (Tierney, 1988, p. 8). Departments and universities convey messages about the relative importance of research, teaching, and service through a number of methods, some of which they may not even be aware of. Closer inspection of the perceptions of faculty and GTAs regarding these topics could help to guide the "visible and invisible hand" (Eble, 1976, p. 62) of the employing institution as it relates to the teaching of GTAs and faculty.

Raising Awareness

Although 21.25% of GTA examples of departmental support for good teaching related to the sharing of teaching tips, advice and resources among GTAs and even faculty, Shulman (1993) described the need to step away from teaching as a solitary experience at the university level. It would appear that improvements have been made in the openness of colleagues who are teaching undergraduate courses, but that GTA

training methods and purposes are currently going unannounced and unshared. One possible method of bringing clarity to the definition of support at a departmental level is to encourage those university personnel who are working with GTAs and training GTAs to be more vocal about what they are doing and why they believe it is important. This type of documentation has the potential to raise the awareness of department members (including GTAs) about the importance of the professional development of graduate students and future faculty. Additionally, higher departmental awareness of GTA support could lead academic advisors to become more understanding of time allotted to teaching and GTA training, and future researchers would be better able to obtain consistent data from all department members about the availability and type of training offered to GTAs.

A Shared Departmental Message about Teaching

In a 1993 article in *Change* magazine, Lee S. Shulman made three suggestions to change teaching from a private practice to a public practice in order to promote "greater recognition and reward attached to teaching" (no page). These suggestions include peer-reviewing teaching, and documenting teaching in much the same way that scholars document research. The key suggestion is to discontinue the practice of considering teaching as a generic add-on to professional development across campuses; teaching is discipline specific. In this study, the seven institutions classified as "with training" on the rigorous 2-item Training Scale all offered departmental training and support to their math GTAs. In five of these departments, 100% of the GTAs responded on the survey as having participated in training of some sort, and at the remaining two schools, 91.7% and 92.3% of GTAs indicated participating in "TA training of any type." Perhaps at the

departmental level, GTA workshops and seminars are able to be of longer duration and more specific to the concerns of GTAs teaching mathematics than university-wide orientations and workshops. Departmental emphasis on GTA training could yield more uniform GTA perceptions of having actually been trained and assisted on the path towards good teaching.

The data collected here to describe support structures available to math GTAs provide examples of recognized support for good teaching in mathematics departments across the country. Carnegie Classification and availability of training were not as indicative of GTA attitudes toward teaching and perceptions of support for good teaching as the researcher had suspected based on the literature. Simple gestures are noticed, however, and through the voices of those GTAs who replied to item 14a, it is apparent that university partners can make inexpensive changes to promote the importance of teaching which will be worthwhile in achieving quality undergraduate instruction. For example, one GTA described an advisor who was "*eager/happy to teach lower level courses*" and another cited that it is "*easy to get advice about problems or ideas for new ways to demonstrate ideas*" as examples of departmental displays of support for good teaching. University departments would benefit from recognizing the impact of "*everyone in the department (faculty, staff, TA's, advisors, etc.) [being] extremely encouraging and willing to help in any way that they can*" when the issue of graduate students teaching arises.

Final Remarks

The research conducted here examined mathematics graduate teaching assistants in an effort to help explain a piece of the picture about GTAs, their perceptions, and their attitudes toward teaching. In addition to their current responsibilities serving as primary instructors for many undergraduate courses (Prieto, 1999; Prieto and Altmaier, 1994; Rushin et al., 1997; Talkakar et al., 1993), today's graduate teaching assistants are tomorrow's faculty (Diamond and Gray, 1987; McGivney-Burelle et al, 2001). As the large portion of faculty hired approximately four decades ago near retirement, a new generation of university professors will begin the task of balancing research, teaching, and service. "Professional development should not be reserved for assistant professors or for those who are somehow deemed ineffective; instead, it starts in graduate school and meets the needs of faculty members throughout their careers" (Hutchings, Huber & Golde, 2006, no page).

Most universities have as a part of their mission a commitment to excellence in teaching undergraduates and helping students to become lifelong learners. Because of their current (and future) role in the teaching of undergraduate courses, GTAs in a variety of departments are responsible for accomplishing the teaching tenet of their institution's mission statement. Any insights, such as those provided by the current study, into factors that are related to teaching effectiveness in GTAs can benefit GTAs, university faculty, and undergraduate students. Although there are many diverse variables available for exploration, Carnegie Classification, availability of training for GTAs, and departmental support of good teaching have here been related to math GTA attitudes toward teaching.

There is little a single department can do to change its home university's Carnegie Classification, but math departments can strive to support good teaching by establishing teaching and GTA teacher-training as more salient aspects of departmental value, conversation, and culture.

REFERENCES

REFERENCES

Barrington, E. (2001). Encouraging professional training of graduate teaching assistants. *Journal of Graduate Teaching Assistant Development, 8*(3), 107-113.

Belnap, J. (2005). Putting TAs into context: Understanding the graduate mathematics teaching assistant (Doctoral dissertation, The University of Arizona, 2005). *Dissertation Abstracts International, 66* (06A), 2142.

Bingman, R. M. (1983, May). *Use of student evaluations to improve instruction.* Paper presented at the Annual Forum of the Association for Institutional Research, Toronto, Ontario.

Blackburn, R. T. (1993). Faculty at work. In M. Weimer (Ed.), *Faculty as teachers: Taking stock in what we know* (pp. 25-28). PA: National Center on Postsecondary Teaching, Learning and Assessment.

Borkowski, N. A. (2001). A retrospective view of the graduate teaching assistantship experience (Doctoral Dissertation, Miami University, 2001). *Dissertation Abstracts International, 63*(01A), 104.

Bort, M. B. (1989). "Being a bus tour guide really helped with rapport building": The relationship of training and prior teaching experience to GTA self-perceived teaching effectiveness. (Masters thesis, Central Michigan University, 1989). *Masters Abstracts International, 28,* 0010.

Bourque, L. B. & Fielder, E. P. (2003). *How to conduct self-administered and mail surveys* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Boyer, E. L. (1990). *Scholarship reconsidered: Priorities of the professoriate.* Princeton, NJ: The Carnegie Foundation for the Advancement of Teaching.

Buerkel-Rothfuss, N. L., & Gray, P. L. (1989). *Graduate teaching assistant (GTA) training: The view from the top.* (ERIC Document Reproduction Service No. ED318351).

Carmines, E. G., & Zeller, R. A. (1979). *Reliability and validity assessment.* Newbury Park: Sage.

Carnegie Foundation (2001). *The Carnegie Classification of Institutions of Higher Education.* Retrieved March 25, 2005, from http://www.carnegiefoundation.org/Classification/index.htm

Carnegie Foundation (2005). *The Carnegie Classification of Institutes of Higher Education*. Retrieved February 8, 2006, from http://www.carnegiefoundation.org/classifications/index.asp

Commander, N. E., Hart, L., & Singer, M. (2000). Preparing tomorrow's faculty: An assessment model to determine institutional needs. *Journal of Graduate Teaching Assistant Development, 7*(2), 93-111.

Daniel, W. W. (1990). *Applied nonparametric statistics* (2nd ed.). Australia: Duxbury.

DeFranco, T. C. & McGivney-Burelle, J. (2001). The beliefs and instructional practices of mathematics teaching assistants in a mathematics pedagogy course. In: *Proceedings of the Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (23rd, Snowbird, Utah, October 18-21, 2001), pp. 681-90.

Delaware Study (2006). *The Delaware study of instructional costs and productivity (Delaware I)* (Montana State University Office of Planning and Analysis). Retrieved September 15, 2006, from http://www.montana.edu/opa/delawaredesc.html

Diamond, R. M., & Gray, P. J. (1987, November). *A national study of teaching assistants*. Paper presented at the Annual Meeting of the Association for the Study of Higher Education, Baltimore, MD.

Dick, R. C. (1985, November). *Helping teachers become better teachers*. Paper presented at the Annual Meeting of the Speech Communication Association, Denver, CO.

Eble, K. E. (1983). *The aims of college teaching*. San Francisco: Jossey-Bass.

Eble, K. E. (1976). *The craft of teaching: A guide to mastering the professor's art*. San Francisco: Jossey-Bass.

Garet, M. S., Birman, B. F., Porter, A. C., Desimone, L., & Herman, R. (1999). *Designing effective professional development: Lessons from the Eisenhower Program [and] technical appendices* (Report No. ED/OUS99-3). Washington, DC: American Institutes for Research. (ERIC Document Reproduction Service No. ED442634).

George, D. & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference* (4th ed.). Boston: Pearson Education, Inc.

Gliner, J. A., & Morgan, G. A. (2000). *Research methods in applied settings: An integrated approach in design and analysis*. Mahwah, NJ: Lawrence Erlbaum.

Graff, H. W. (1994). A study of the faculty and teaching assistants at a large middle states urban university: Motivational and support requirements for improving instruction. (Doctoral dissertation, Temple University, 1994). *Dissertation Abstracts International, 55,* 2292.

Gray, P. L., & Buerkel-Rothfuss, N. L. (1989, November). *Graduate teaching assistant (GTA) training: The view from the trenches*. Paper presented at the National Conference on the Training and Employment of Teaching Assistants, Seattle, WA.

Grunwald, H & Peterson, M. W. (2003). Factors that promote faculty involvement in and satisfaction with institutional and classroom student assessment. *Research in Higher Education, 44*(2), 173-204.

Guentzel, M. J., Tagliapietra-Nicoli, G., Whitt, E. J., & Elkins, B. S. (2005, November). *Learning to teach?: Experiences of graduate teaching assistants in principles of chemistry*. Paper presented at the Annual Meeting of the Association for the Study of Higher Education, Philadelphia, PA.

Halpern, D. F. (1994). Rethinking college instruction for a changing world. In D. F. Halpern & Associates (Eds.), *Changing college classrooms: New teaching and learning strategies for an increasingly complex world* (pp. 1-10). San Francisco: Jossey-Bass.

Hutchings, P., Huber, M. T., & Golde, C. M. (2006, September 13). *Integrating work and life: A vision for a changing academy.* Retrieved September 15, 2006, from http://www.carnegiefoundation.org/perspectives/september2006.

LaCelle-Peterson, M.W. (1993). Moving teaching to the top of individual and institutional agendas. In M. Weimer (Ed.), *Faculty as teachers: Taking stock in what we know* (pp. 75-78). PA: National Center on Postsecondary Teaching, Learning and Assessment.

Lin, P. (2002). On enhancing teachers' knowledge by constructing cases in classrooms. *Journal of Mathematics Teacher Education, 5*(4), 317-349.

Loucks-Horsley, S., Hewson, P. W., Love, N., & Stiles, K. E. (1998). *Designing professional development for teachers of science and mathematics*. Thousand Oaks, CA: Corwin Press.

Lumsden, A. S. (1989). Does having formal training in instruction improve the attitude and performance of graduate student teaching assistants? (Doctoral dissertation, Florida State University, 1989). *Dissertation Abstracts International, 51,* 141.

McGivney-Burelle, J., DeFranco, T. C., Vinsonhaler, C. I., & Santucci, K. B. (2001). Building bridges: Improving the teaching practices of TAs in the mathematics department. *Journal of Graduate Teaching Assistant Development, 8*(2), 55-63.

McKeachie, W. J. (1994). *Teaching tips: Strategies, research, and theory for college and university teachers* (9th ed.). Lexington, MA: D. C. Heath.

Moore, M. S. (1996). Assessing college teaching effectiveness: A comparison of graduate teaching assistants and their students (Doctoral dissertation, Auburn University, 1996). *Dissertation Abstracts International, 57,* 1931.

National Center for Educational Statistics (2005). *IPEDS Peer Analysis System.* Retrieved July 27, 2006 from, http://nces.ed.gov/ipedspas/report on vars.asp

Nyquist, J. D., Abbott, R. D., & Wulff, D. H. (Eds.). (1989). *Teaching assistant training in the 1990s.* New Directions for Teaching and Learning, no. 39. San Francisco: Jossey-Bass.

Nyquist, J. D. & Wulff, D. H. (1986). *The training of graduate teaching assistants at the University of Washington.* Seattle, WA: Center for Instructional Development and Research. (ERIC Document Reproduction Service No. ED289433).

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Popham, W. J. (2000). *Modern educational measurement: Practical guidelines for educational leaders.* Boston, MA: Allyn and Bacon.

Prieto, L. R. (1999). Teaching assistants' preferences for supervisory style: Testing a developmental model of GTA supervision. *Journal of Graduate Teaching Assistant Development, 6*(3), 111-118.

Prieto, L. R., & Altmaier, E. M. (1994). The relationship of prior training and previous teaching experience to self-efficacy among graduate teaching assistants. *Research in Higher Education, 35*(4), 481-497.

Prieto L. R. & Meyers, S. A. (2001). *The teaching assistant training handbook: How to prepare TAs for their responsibilities.* Stillwater, OK: New Forums Press.

Ralph, E. G. (2001). Effective instruction: A synthesis of research-based principles for GTAs. *Journal of Graduate Teaching Assistant Development, 8*(1), 13-20.

Rushin, J. W., DeSaix, J., Lumsden, A., Streubel, D. P., Summers, G., & Bernson, C. (1997). Graduate teaching assistant training: A basis for improvement of college

biology teaching and faculty development. *The American Biology Teacher, 59*(2), 86-90.

Shannon, D. M., Twale, D. J., & Moore, M. S. (1998). TA teaching effectiveness: The impact of training and teaching experience. *The Journal of Higher Education, 69*(4), 440-446.

Shulman, L. S. (1993). Teaching as community property: Putting an end to pedagogical solitude. *Change, 25*(6).

Siegle, D. (n.d.). *Likert Scale*. Retrieved March 29, 2005, from University of Connecticut, Neag School of Education Web site: http://www.gifted.uconn. edu/siegle/research/instrument%20Reliability%20and%20Validity/Likert.html

Smith, K. S. (2001). Pivotal events in graduate teacher preparation for a faculty career. *Journal of Graduate Teaching Assistant Development, 8*(3), 97-105.

Smith, M. (1993). Partners in learning: Collaboration around teaching. In M. Weimer (Ed.), *Faculty as teachers: Taking stock in what we know* (pp. 115-118). PA: National Center on Postsecondary Teaching, Learning and Assessment.

Talkakar, P., Micceri, T., & Eison, J. (1993, November). *Tomorrow's professors: Helping university teaching assistants develop quality instructional skills.* Paper presented at the combined Annual Meeting of the Southern Association for Institutional Research and the Society for College and University Planning, Memphis, TN.

Tierney, W. G. (1988). Organizational culture in higher education: Defining the essentials. *The Journal of Higher Education, 59*(1), 2-21.

U.S. Census Bureau (n.d.). *Census Regions and Divisions of the United States*. Retrieved May 16, 2006, from http://www.census.gov/geo/www/us_regdiv.pdf

APPENDICES

APPENDIX A:

REPORT OF SURVEY DEVELOPMENT

Report of Survey Development

In Spring, 2005, the researcher created a survey instrument to assess GTAs'

perceptions of teaching effectiveness. Literature on teaching effectiveness at the K-12

and university levels (Bingman, 1983; Bort, 1989; Lumsden, 1989; McGivney-Burelle et

al., 2001; McKeachie, 1994; Ralph, 2001; Talkakar et al., 1993) was examined for

characteristics of effective secondary instructors. Analysis of these characteristics led to

five general categories describing traits of effective teachers:

    1) strong knowledge of content/subject matter being taught

    2) interest in students/fostering a positive learning environment

    3) organization, preparation, and clarity of presentation

    4) enthusiasm/positive attitude towards teaching

    5) prompt feedback and fairness in grading.

After establishing these categories, the researcher created a sample survey that might

obtain background information about each participant, as well as self-perceptions of

personal teaching effectiveness. Three yes/no statements were created to address GTAs'

perceived performance "most of the time" in each of the above effectiveness categories

(question 7).

    The sample survey was given to three experts in the fields of education and

mathematics education in order to assess content validity of the instrument. In addition to

these experts, two mathematics GTAs in the researcher's department completed and

analyzed the survey. As a result of discussions with these five individuals, the researcher

made minor adjustments to the instrument, although the overall purpose of the survey

remained unchanged. Yes/no statements were changed to a Likert-type frequency scale (Siegle, n.d.) in an effort not only to allow respondents to be more honest, but also to recognize teaching effectiveness as a skill that can be nurtured and developed (Eble, 1976). The wording was changed on some statements to increase clarity, and the directions were modified to specifically address the current academic term. One effectiveness statement was added to question 7, and four individual statements about perceptions of teaching being valued in the GTA's math department were added (question number 9).

After the above changes had been made, the researcher randomized the 16 statements regarding teaching effectiveness and category subheads were removed. Approval from the researcher's university's Institutional Review Board was received on March 29, 2005 for administration of an educational survey. The researcher distributed surveys to 35 GTAs in the math department at her home institution on Monday, April 4, 2005. The researcher sent a general email to the math department's 56 GTAs soliciting volunteers to complete a 5-minute survey, and throughout the day 35 surveys were completed by volunteer masters and doctoral level GTAs. These GTAs were assumed to be a representative sample of the population of math GTAs at Research Universities—Intensive (R/I) since the researcher's home institution is a western land grant university classified by the Carnegie Foundation (2001) as a Research University—Intensive. Through verbal feedback from participants, as well as some written comments on the actual surveys, slight modifications were again made to the survey to increase clarity; the 16 statements regarding teaching effectiveness (question 7) remained unchanged. These

improvements may have had an impact on the retest reliability (discussed shortly) of the instrument.

Between-testing intervals of two weeks to one month are recommended to establish test-retest or stability reliability (Nunally, as cited in Carmines and Zeller, 1979; Popham, 2000). On Friday, April 29, 2005 the second administration of the survey was conducted with the 35 initial participants in an effort to gain data to assess retest reliability of the survey. By Monday afternoon, May 2, 2005, 29 surveys had been collected, 26 with usable data (three had either no identification number listed, or an incongruous identification number). A complete copy of the survey instrument distributed on April 29, 2005 is included at the end of this Appendix.

The researcher entered data from the original and retest surveys into a Microsoft Excel spreadsheet, using the last four digits of participants' social security numbers to identify them. The third, sixth, tenth, and fifteenth items in question number 7 about teaching effectiveness are negatively worded, and the responses were reverse-coded. The non-parametric Goodman-Kruskal G Coefficient for ordinal data was found for each survey item in questions 7 and 9, the two questions regarding non-demographic data. G is defined as the difference between the probability that (in this case) original and retest responses agree and the probability that original and retest responses disagree; values range between -1 and +1 (Daniel, 1990). For the pilot survey, Goodman-Kruskal Coefficients on question 7 ranged from $G=.38$ to $G=.96$ with a median value of $G=.78$. Reliability coefficients on question 9 ranged from $G=.37$ to $G=.70$ with a median value of $G=.50$.

Pilot Graduate Teaching Assistant Survey

This survey is being conducted under guidelines established by Montana State University. Your responses will allow researchers to answer important questions about Teaching Assistants. Completing this survey will not benefit you in any way, nor will it harm you.
Estimated time needed to complete survey: 5 minutes

For each question, please mark the appropriate box:

1. What degree are you currently working towards?   ☐ masters   ☐ doctorate

2. What is the highest degree you have earned?   ☐ bachelors ☐ masters ☐ doctorate

3. What is the highest math degree you have earned? ☐ bachelors ☐ masters ☐ doctorate

4. What is your gender? _____

5. For how many terms (semesters, quarters, and summers) have you had a Teaching
      Assistantship in math (include the current term)? _____

6. Have you taught at least *one* semester (do NOT count student teaching) in a K-12 setting?

      ☐ yes   ☐ no

7. For each of the following statements, please indicate the extent to which the statement describes your college teaching *this term*, where:

      1=never, 2=rarely, 3=about half the time, 4=usually, 5=always.

1 2 3 4 5 I look forward to time spent with students in class.

1 2 3 4 5 I grade assignments in a timely manner to return to students.

1 2 3 4 5 I spend less than ten minutes preparing for each day's class.

1 2 3 4 5 I have a strong understanding of the mathematics that I teach.

1 2 3 4 5 I respond promptly to student emails.

1 2 3 4 5 If a student asks a question, it is difficult to think of relevant examples "on
                the spot."

1 2 3 4 5 If I find that a student is uncomfortable asking questions in class, it troubles
                me.

1 2 3 4 5 When grading, I provide feedback to students beyond marking right or wrong.

1 2 3 4 5 I have had students tell me that they appreciate my enthusiasm for math.

1 2 3 4 5 For the math topics I teach, I struggle to explain them in more than one way.

1 2 3 4 5   I am careful to ensure that each day's presentation is clear.

1 2 3 4 5   I encourage my students to attend my office hours.

1 2 3 4 5   I seek ways to improve as an instructor.

1 2 3 4 5   My lectures are well-organized.

1 2 3 4 5   I would prefer a research assistantship to my teaching assistantship.

1 2 3 4 5   I try not to look at students' names while grading exams.

8. Mark the statement that is *most like* your highest level of responsibility as a Teaching
      Assistant *this term*:

☐ I work in the math learning center, tutor students, and/or grade other instructors' students'
      work.

☐ I lead a recitation or homework session only, and do not plan lectures.

☐ I plan class lectures, I write and grade quizzes, but I am not responsible for creating the
      course syllabus.

☐ I plan class lectures; I have primary control of creating the syllabus; I write and grade
      exams.

9. To what extent do you agree with the following statements?
     1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree

1 2 3 4 5   My major professor/advisor values good teaching among Teaching
                    Assistants.

1 2 3 4 5   My *current* course supervisor values good teaching among his/her Teaching
                    Assistants.

1 2 3 4 5   Most faculty in my department value good teaching among Teaching
                    Assistants.

1 2 3 4 5   My department values good teaching among its Teaching Assistants.

Thank you for your time and honesty in completing this survey.

APPENDIX B:

FINAL TEACHING ASSISTANT SURVEY

Final Teaching Assistant Survey

TEACHING ASSISTANT SURVEY

Please complete and mail by : _____
Estimated time to complete: 7 minutes

For each question, please indicate the most appropriate answer:

1. At what college or university are you a graduate student? _____

2. What degree level are you currently working towards? ☐ masters ☐ doctorate

3. What is your current program of study/ area of curriculum?

   ☐ mathematics ☐ math education ☐ statistics ☐ other (please list) _____

4. What is the highest degree you have earned? ☐ bachelors ☐ masters ☐ doctorate

5. What is the highest *math* degree you have earned? ☐ bachelors ☐ masters ☐ doctorate

6. What is your gender? _____

7. Are you an international student? ☐ yes ☐ no

8. For how many terms (semesters, quarters, and summers) have you had a Teaching Assistantship in math/ statistics/math education (include the current term)? _____

9. Do you hold an undergraduate degree in education? ☐ yes ☐ no

10. Have you taught at least one semester (do NOT count student teaching) in a K-12 setting? ☐ yes ☐ no

11. Have you participated in TA training of any type? ☐ yes ☐ no

   11a. If you *have* participated in TA Training of some type, please briefly describe the training, including length, type, sponsor, etc.

12. Mark the statement that is *most like* your highest level of responsibility as a Teaching Assistant *this term*:

   ☐ I work in the math learning center, tutor students, and/or grade other instructors' students' work.

   ☐ I lead a recitation or homework session only, and do not plan lectures.

   ☐ I plan class lectures, I write and grade quizzes, but I am not responsible for creating the course syllabus.

   ☐ I plan class lectures; I have primary control of creating the syllabus; I write and grade exams.

13. For each of the following statements, please indicate the extent to which the statement describes your college teaching *this term*, where: **1=never, 2=rarely, 3=about half the time, 4=usually, 5=always.**

Never	About half the time	Always	
1 2 3 4 5			I look forward to time spent with students in class.
1 2 3 4 5			I have had students tell me that they appreciate my enthusiasm for math.
1 2 3 4 5			I seek ways to improve as an instructor.
1 2 3 4 5			I would prefer a research assistantship to my teaching assistantship.

14. Based on your experiences in *this* mathematics department, please answer the following questions to the best of your knowledge. The scale is as follows: **1=not at all supportive, 3=somewhat supportive, 5=strongly supportive**; if you have no opinion or the item is not applicable to you, please mark the box.

	Not at all supportive		somewhat supportive		strongly supportive	N/A
How supportive of good teaching is your major professor/ advisor?	1	2	3	4	5	☐
How supportive of good teaching is your *current* course supervisor?	1	2	3	4	5	☐
How supportive of good teaching are most TAs in your math department?	1	2	3	4	5	☐
How supportive of good teaching are most faculty in your department?	1	2	3	4	5	☐
How supportive of good teaching is your math department?	1	2	3	4	5	☐

14a. If you marked a response of "4" or "5" for any of the above items, please give an example of a display

   of support given by that person or people:

APPENDIX C:

DEPARTMENT CHAIR/HEAD PHONE INTERVIEW SCRIPT

Department Chair/Head Phone Interview Script

School Name:

Spoke To: Day, Time:

Interested in a copy of results?

TA Training Available?   Required?

Who Designs and Conducts it?   Dept?   Univ?   Students?   Faculty?

Duration/Format?   Before Classes?   Across Semester?   Across Year?

General Content?   Orientation?   Course-specific meetings?

Training Specific to International TAs?

Other??

Support for TAs having problems (academic and teaching-related)?

Department Teaching Awards for: GTAs   Faculty

College Teaching Awards for: GTAs   Faculty

University Teaching Awards?   GTAs   Faculty

Center for Teaching and Learning on-campus?

Other Teaching Support Structures Available to TAs?

APPENDIX D:

SAMPLE COVER LETTERS

Sample Department Cover Letter

November 3, 2005

xxxxx University
Department of Mathematics
City, State, xxxxx

Dear Department Chair/Head:

I am a graduate student at Montana State University working on my dissertation in an effort to obtain a Ph. D. in Mathematics with an emphasis in Mathematics Education. I am collecting information about demographics and perceptions of Graduate Teaching Assistants in Mathematics departments at a variety of institutions across the United States. Because Mathematics departments at many colleges and universities employ GTAs to teach undergraduate courses it is important to gain a clear understanding of factors related to their teaching abilities and teaching effectiveness. The data collected through these surveys will potentially be helpful to administrators at graduate degree granting institutions as the dialogue regarding teaching assistants continues.

Enclosed are ## surveys asking for information about GTA demographics and perceptions regarding teaching. I ask that you distribute one survey to each graduate student (masters or doctoral level) *in your department* who has at least partial responsibility for the material taught in an undergraduate level mathematics, statistics, or mathematics education course. For your convenience, the responsibility to complete and return the survey will rest with each GTA. A separate cover letter for each GTA, as well as a postage paid return envelope are attached to each survey.

If you have any questions about my survey please either write to me at the email address below, or feel free to call me (406-994-5362) or my advisor, Dr. Janet Sharp (406-994-3322). I anticipate completing my dissertation by Fall, 2006. If you would be interested in a copy of the results of this study, please don't hesitate to contact me.

The input from your department's GTAs will provide valuable information and will greatly assist me in my dissertation progress. I thank you in advance for your assistance with this study.

Sincerely,

Christine Latulippe
clatulip@math.montana.edu

cc: xxxxxxxxxx

Sample GTA Survey Cover Letter

Dear Graduate Teaching Assistant:

I am a graduate student in the mathematics department at Montana State University, collecting data about Teaching Assistants for my doctoral dissertation. I would greatly appreciate your help.

Please take about 7 minutes to complete the attached survey regarding TAs and your perceptions about teaching. **Your input is important**. The results of this survey will be used for academic purposes only, and will be presented in summary form to ensure that your responses remain strictly confidential.

The survey data supplied by every GTA contacted will provide valuable information and greatly assist me with my dissertation study. After completing the survey, please return it in the attached postage paid envelope. I am requesting that completed surveys be returned by November 18, 2005.

If you have questions or are interested in receiving a copy of the study results upon completion, please don't hesitate to contact me. Thank you in advance for your time and honesty in completing this survey.

Sincerely,

Christine Latulippe
(406) 994-5362
email: clatulip@math.montana.edu