Graduate Teaching Assistant Instructor Expertise and Algebra Performance of College Students

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Abstract

This longitudinal study examined the relationship between level of GTA instructional expertise, amount of GTA teaching experience, and academic performance of their college algebra students measured by course grades. College algebra grades for all students in classes taught by GTAs over six years and 43 sections were analyzed (n = 2,198). The most salient result of the present study pertained to withdraws from college algebra. A chi-square analysis indicated there was a statistically significant relationship between GTA Training and Years in GTA position on withdraws from college algebra. Noteworthy is the fact that success in lowering the drop rate in the treatment group occurred when students were drawn from the same pool, exposed to the same content at the same pace, and followed the same placement scheme as students in the control group. In addition, the design of the research had controls in place to extract any influence of prior math knowledge.

Introduction

In their important role as educators, graduate mathematics students with teaching assistantships face unique professional challenges and limitations. For many graduate teaching assistants (GTAs) it is their first experience teaching autonomously in an academic setting. Yet, college and university mathematics departments have traditionally overlooked preparing GTAs for their jobs as classroom instructors. Even though these students are usually very talented young mathematicians, knowledge of mathematics does not necessarily indicate the ability to convey that knowledge to others. Bass (1997) stated, "…knowing something for oneself or for communication to an expert colleague is not the same as knowing it for explanation to a student.

Further, the experience of a mathematical scientist as a learner may not be the best model for the learning of his/her student" (p.19).

Teachers are a very important part of the classroom environment. The inference drawn from research is that instructor expectancies and beliefs influence students' motivation, attitudes, and achievement (Bass, 1997; Enon, 1995; Friedberg, 2001; Luebeck, 1998). Furthermore, Enon (1995) suggested that teacher efficacy is a critical variable in teacher and school effectiveness, more particularly in mathematics and science-related fields. A great deal has been learned in the past decade about the kinds of skills and awareness necessary to be effective in communicating mathematics. The once common view that teaching cannot be taught is being refuted (Rishel, 2000).

Teachers of mathematics need both knowledge of content and knowledge of the best way to teach that content to students. Pedagogical content knowledge or subject-specific pedagogical knowledge consists of how to represent specific topics and issues in ways that are appropriate to the diverse abilities and interests of learners (Borko, Eisenhart, Brown, Underhill, Jones, & Agard, 1992). Brown and Borko (1992) said this requires making the transition from a personal orientation to a discipline to thinking about how to organize and represent the content of the discipline to facilitate student understanding. Naturally, GTAs need support and guidance in making this transition from learner to learning to teach.

"Mathematics education, unlike mathematics itself, is not an exact science; it is much more empirical and inherently multidisciplinary. Its aims are not intellectual closure but helping other human beings, with all of the uncertainty and tentativeness that that entails" (Bass, 1997, p.21). Still, apart from the role models of their mentors, graduate mathematics students who typically spend about half of their time teaching often receive little or no professional

development as educators. The problem is compounded by pairing anxious, undergraduate college algebra students with GTA instructors who are ill-equipped.

Undergraduate Education Concerns

Researchers in higher education have suggested that for decades universities and colleges gave little regard to the impact of GTAs on undergraduate education (Boyer, 1990; Sykes, 1988). Sykes (1988) said that the professoriate, in pursuit of research, grants, and academic politicking, has left undergraduate students in the care of under-prepared and under-paid GTAs. During the late 1980's, in response to the sharp criticism about the practice of using graduate students as inexpensive labor, many GTA orientation and training programs were started at colleges and universities across the United States (Bartlett, 2003). Now, as tuition costs rise, there are renewed allegations about continuing to man undergraduate courses with GTAs just because they are available and affordable (Bartlett, 2003; Shannon et al., 1998).

Research about college student learning and development clearly shows that student learning is "unmistakably linked to effective teaching" (Pascarella & Terenzini, 1992, p.182). "Students in freshman classes are just a few months removed from high school, where teachers are required to have a license and certificates showing that they have received training in methods of instruction for work with adolescents. Many high school teachers have earned a master's degree in education, which often entails further intensive pedagogical training. This disparity between preparation for high school teaching and college teaching is immense and suggests that pedagogical training for prospective college teachers should be part of the graduate curriculum" (Feldhusen et al., 1998, p. 72).

Graduate Students in the Role of Teaching Assistants

Graduate students report anxiety about their upcoming journey comparable to their first days as college freshman (Rosenblatt & Christensen, 1993). Orientation sessions are designed to familiarize new graduate students with the academy (Boyle & Boice, 1998); however Poock (2004) found that many of these efforts fall short. Graduate teaching assistants report the educational and instructional environment very complex to navigate (Luft et al., 2004). In a collaborative, multi-site research project, Nyquist and his colleagues (1999) examined how graduate students develop into faculty members. The interviews found three common foci: adapting to values, mixed messages, and requests of support. Graduate students said that they spent a significant amount of time trying to demystify the values of the academy and that they received ambiguous messages about the merit of teaching and research. Their desire for support in teaching was expressed by an overwhelming majority of the participants. The researchers characterized this as an urgent call. "Although we certainly did not expect that our participants' mid-point representations of their graduate journeys would include depictions of them wandering through alpine meadows picking wildflowers, we were somewhat amazed to see the number of precipices, perilously steep slopes, chasms, and traps that many drew. Of more concern to us was the absence in most of the pictures of safety nets, guides, ropes, pitons, or other means of assistance" (p.4).

Other reports had similar findings. The common stresses encountered in this phase of the education process were balancing time commitments and concerns about teaching (Feezel & Myers, 1997) with too little guidance (Diamond & Gray, 1987). Graduate teaching assistants are given a great deal of responsibility for undergraduate education (Shannon et al., 1998) and

generally try to provide good learning environments for their students (Luft et al., 2004), but they need more assistance than they are currently receiving**.**

GTA Training

Research finds recurring recommendations to assist graduate students in dealing with the common conflicts they encounter as GTAs. The prevalent suggestion by those that have studied the problem is implementation of a comprehensive teacher training program for GTAs with structured supervision by experienced faculty (Bass, 1997; Glickman & Bey, 1990; Kuther, 2003; Prieto & Meyers, 1999). In her study examining state policies designed to improve undergraduate instruction and learning, Colbeck (2002) concluded that to be most effective these policies should be aimed at the department level of colleges and universities. Otherwise, layers of management become an obstacle between the policy and the faculty who implement the policy, with the resulting impact on undergraduate education unsure (Jones & Ewell, 1993). When graduate students are provided useful educational training they acquire effective teaching behaviors (Abbott, Wulff, and Szego, 1989) and increased self-efficacy, which is tied to classroom performance (Prieto & Altmaier, 1994). Graduate students agree with this suggestion. They identify a need for improved training and increased mentorship opportunities (Diamond & Gray, 1987; Nyquist et al., 1999). Graduate teaching assistant (GTA) unions are asking that professional development for teaching be a part of their contracts with the universities (Luft et al., 2004).

Bass (1997) called the communications skills inherent in teacher training a necessary component of a comprehensive program to ensure that graduate students are professionally versatile. “At the very least, our graduate students, who regularly perform as TAs or instructors, must be given serious teaching preparation…Even if their career paths do not take them into the

academic world, much of what they need to learn in the way of teaching skills forms part of the broader need for better communication skills in diverse settings. This will make them better and more effective spokespersons in their work and communities…" (p.21).

There is little empirical research examining the effects of GTA training in the literature. Previous studies have called for more research to assess the effectiveness of GTA training (Abbott, Wulff, & Szego, 1989) and specifically to examine the effects of specialized departmental training (Shannon, Twale, & Moore, 1998). This study seeks to add to the literature by providing a comprehensive model for training and supporting mathematics GTAs at the departmental level, and analyzing quantitative data about student performance in college algebra courses taught by GTAs. Findings from this study may assist mathematics departments at colleges and universities in preparing and supporting GTAs who teach undergraduate courses.

The purpose of the present longitudinal study was to investigate the relationship between instructor participation in a GTA professional development program and academic performance of college algebra students measured by course grades. Furthermore, the relationship between algebra performance of college students in courses taught by first year GTAs and second year GTAs was examined.

Method

Participants

All of the participants in the present study were enrolled in sections of MATH 113, College Algebra, taught by GTAs at a midsized Midwestern University during the spring and fall semesters over the years 1999 to 2005. The University remains a traditional college campus with nearly 98% of credit hours produced in the traditional classroom on the campus. Approximately 7,000 students are enrolled in the more than 100 undergraduate and graduate programs available in the arts and sciences, business, education and technology.

College Algebra is a required course for all baccalaureate students under the General Education Degree Requirements as stated in the university catalog. Enrollment for the course is approximately 700 students each academic year. College Algebra courses offered during the summer term are not taught by GTAs and not considered in this study. The students were males and females, freshman, sophomores, juniors, and seniors between the ages of 17 and 65. Participants for this study were enrolled in this course, as well as other courses, with the assistance of an academic advisor. Quantitative data was gathered from this purposive sample to examine the relationship between algebra performance among college students and instructor expertise.

Procedure

Important common components of Math 113, College Algebra, during the control and treatment years include general education degree requirements, course syllabi, algebra textbooks, Basic Skills Exams, final exams, and GTA instructors. These standardized conditions of college algebra during the years under investigation help control for potential group differences and allow for investigation of the treatment variable with more reliability.

General Education Degree Requirements. Over the six years of data collection, students at PSU, in consultation with their advisors, enrolled in courses appropriate for their individual programs of study. Under the general education degree requirements stated in the university catalog during the semesters considered in this study, all baccalaureate students, regardless of major, were required to take college algebra. Math 113, College Algebra, is a three hour course at this university.

Course Syllabi. All students in the participating sections of college algebra are exposed to the same set of course topics during the semester. All college algebra classes have a common

day-by-day schedule and a common syllabus of topics and skills outlined by the Kansas Board of Regents. The Core Competency Committee, called by the Kansas Board of Regents, determined minimum core competencies for common courses under its jurisdiction. Mathematics instructors and professors from all of the state institutions in Kansas comprised the committee to develop the mathematics syllabi. To ensure this set of minimum core competencies and department approved learning goals and objectives are taught uniformly in all college algebra courses within the mathematics department, course syllabi are scrutinized by either the GTA supervisor or the department chair.

Textbooks. College Algebra textbooks are selected by committee on the basis of the Kansas state core competencies and department goals and objectives for the course. All sections of college algebra use the same textbook. Day-by-day schedules of textbook sections to teach along with unit test dates are developed each semester by the GTA supervisor and given to all GTAs. During all semesters of the six years under study, the textbook in all sections of college algebra was *College Algebra: Concepts and Models* by Larson, Hostetler and Hodgkins. The publishing company updated the textbook from the third to the fourth edition in 2001 with minimal changes.

Basic Skills Exam. The Basic Skills Exam is an important formal assessment tool used in college algebra at this university. The math department requires a Basic Skills Exam for college algebra in which students must get 9 out of 11 problems completely correct in order to successfully exit the course. Students start taking this exam at the beginning of week 9 of the semester. If a student fails the exam, he or she works one on one with the instructor and tutors and may continue to repeat versions of the exam until week 11 of the semester. If the student still does not pass the exam after week 11, he or she must repeat the course.

The skills tested on the Basic Skills Exam were determined by the department to be necessary for success in the mathematics courses for which college algebra is a prerequisite. Students were required to: multiply binomials, factor trinomials, add rational expressions, solve equations and inequalities, solve systems of equations, simplify radical expressions, and identify linear, quadratic, cubic, and rational graphs.

A computer program was written to algorithmically generate problems for each skill; therefore, each version of the Basic Skills Exam tests the same skills but with different questions. The program was written by the chair of the math department in 1995 and has been in use since then.

Every student from every section of college algebra had to demonstrate mastery of these basic algebra skills to the same high degree of accuracy by passing the standardized Basic Skills Exam during the semesters under study.

Final exam. Students in college algebra take a common comprehensive final exam that is prepared by the full time instructor who coordinates the college algebra sections. All students in all sections of college algebra take this comprehensive final exam on the same date and at the same time.

The contents of final exams during the years under investigation were analyzed for concepts tested, number of questions, and number of questions per concept. Two mathematics instructors participated in this analysis to provide inter-rater reliability and determine if there were any significant differences among the years being studied.

Each of the final exams for the twelve semesters being examined contained questions in six categories: Basics, Algebraic Operations, Solving Equations and Inequalities, Functions, Graphing, and Matrices. The results suggest that no mean differences exist between the number

of questions in each of the six categories during the control years and treatment years. In addition, there was not a significant difference in the total number of questions on the finals in the control group ($M_C = 36.6$) and the treatment group ($M_T = 37.1$). The results of the chi-square test substantiated there were no differences between the groups by content area on the final exams ($\chi^2 = 0.198$, $df = 6$, $p > .995$).

Treatment Procedures

Beginning in the fall 2002 semester, the mathematics department implemented a coordinated program of support and professional development for its GTAs. Release time was given to a tenure-track faculty member for this assignment. Also a new course, MATH 871 Teaching Mathematics, for one-credit-hour was added and required of all GTAs.

Prior to the fall semester 2002, GTAs teaching mathematics attended a fall orientation to cover the department handbook but did not receive any further training. Under the new program, since the fall semester 2002, graduate students teaching in the mathematics department meet for a half day of professional development training before the fall semester begins and then for a one hour class each week throughout the semester. The curriculum for MATH 871 Teaching Mathematics was designed specifically to assist GTAs in their role as educators and to address the unique professional challenges and limitations they face.

Description of Treatment

The following sections describe the program and procedures of the GTA training model used in this study. They comprise information about the orientation session as well as a course description and class procedures for MATH 871 Teaching Mathematics. Two critical components of the professional development training, journal writing and teaching portfolios, are also detailed.

Orientation. In the treatment years, pre-service training for GTAs in the mathematics department was held prior to the start of the fall semester. During this time GTAs were given their assignments, a day by day schedule of textbook sections to teach along with unit test dates. They were provided with a copy of the textbook and ancillary materials to be used for teaching. The typical semester assignment for full-time GTAs consisted of complete responsibility for two, 3-credit-hour sections of college algebra. Both first and second-year GTAs participated in the orientation.

The agenda for the pre-service training included the following sessions:

1. Presentation and discussion of policies of the university and the department as outlined in the Mathematics Department GTA Handbook.
2. Instruction on the common required components of the college algebra syllabus and presentation of sample exemplary course syllabi.
3. Presentation and discussion on introduction activities, ideas for presenting syllabi, and planning day one.

MATH 871 Teaching Mathematics Course Description. The course was designed to promote guidance, direction, and support for GTAs. From inception, the course goal was to encourage excellence in teaching through a program of sharing ideas, concerns, problems, and information on an ongoing basis with GTAs in the mathematics department. No one model was followed in course development. Instead, the aim was to build a unique model that drew from the research on best practices in GTA training and effective programs that fit the needs of mathematics GTAs at this university.

MATH 871 Teaching Mathematics Class Procedures. All GTAs attended an hour-long class once a week with the GTA supervisor. Both new and returning GTAs participated in

class activities with second-year GTAs acting as mentors for new GTAs. At each meeting the agenda consisted of the following activities:

1. Dissemination of departmental information and announcements.
2. Discussion and question/answer dialogue about issues in teaching college algebra encountered by the GTAs during the week.
3. Presentation and discussion of assigned chapters from *Teaching First: A Guide for New Mathematicians* (Rishel, 2000).

Journals. Journal entries were submitted on a weekly basis as a way for the GTA supervisor to have continuing dialogue with individual GTAs and as a vehicle for GTAs to record their own experiences and growth. Graduate teaching assistants were encouraged to reflect intelligently on the work they were doing. Countryman (2000) discussed the benefits of writing to learn stating that "it is important that students participate in the construction of their own knowledge, and writing is a valuable contribution to that process" (p.11). The journal entries included a combination of two writing techniques: learning logs that contained personal accounts of work in teaching; and freewrites that could be reflections, comments, questions, successes, or problems. From time to time a specific writing prompt activity was assigned.

Portfolio. All GTAs maintained teaching portfolios that documented their accomplishments during the semester. The portfolios contained the following items:

1. All documents prepared by the GTA: the course syllabus, testing instruments, worksheets, and class handouts.
2. A personal statement on the philosophy of teaching.

3. Copies of weekly journal entries documenting teaching experiences and professional growth and development.
4. Semester evaluation forms and comment sheets completed by college algebra students.

Results

To assess the effectiveness of GTA training and the influence of GTA experience, course grades in college algebra were used as the dependent variable in this analysis. Students who finished the course were assigned grades of A, B, C, D, or F by their instructors. For the purpose of analysis, these grades were assigned numeric values (e.g., an "A" was assigned a value of 4; a "B" was assigned a value of 3, etc.). Students who withdrew from the course were assigned a grade of W. Of the 2,198 participants, 1,528 (69.5%) completed college algebra and 670 (30.5%) withdrew from the course.

Examination of Grades of Students who Completed the Course

Of the 2,198 participants, 1,528 (69.5%) completed college algebra with an average grade of 2.65 (approximately C+). The course grade data for students who finished the course were entered into a 2 (Trained) x 2 (Year) analysis of covariance with Math ACT scores as the covariate. Covariates are influential variables that affect the dependent variable but do not interact with any of the other factors being tested at the time. Therefore, since prior mathematics knowledge was present during the study, using Math ACT scores as a covariate in the analysis allowed for control of its influence.

The results of the analysis of covariance revealed that there were no main effects or interactions involving Trained (Yes or No) or Year (1 or 2). The only main effect was that of Math ACT, $F(1,1527) = 170.11$, $p < .0001$. No other main effects or interactions are statistically

significant. There was no main effect of experience as a GTA, F(1,1527) = 1.67, p = 0.1959 >.05. There was no main effect of GTA training, $F(1,1527) = 2.93$, $p = 0.0871 > .05$. In addition, there was not a significant interaction effect of GTA training and length of time as a GTA, $F(1, 1527) = 3.01$, $p = .0828 > .05$. The non-significant training - year interaction suggests that length of time as a GTA does not moderate the relationship between training and algebra grades.

The results of this analysis indicated that students' math abilities (MACT) explained the variability in course grades rather than the GTAs' training or experience.

Examination of Withdrawals Only

Of the 2,198 participants, 670 (30.5%) withdrew from college algebra. For those who withdrew, 60.5% withdrew from classes taught by GTAs who were not trained and 39.6% withdrew from classes taught by GTAs who were trained. Most importantly, upon examination of the frequency of withdraws for trained by year (see Table 1), there were fewer withdraws (8.8%) from classes taught by GTAs who had been trained and had two years of experience teaching than from any other subgroup, $\chi^2(1) = 101.610$, $p = 0.000 < .05$.

Table 1

Frequency Table of Withdraws for Trained by Year

	Year of Teaching	
Training Status	1	2
Not Trained	154 (23.0%)	251 (37.5%)
Trained	206 (30.8%)	59 (8.8%)

To examine the effect of Math ACT scores, three groups were created; high, medium and low Math ACT groups. Membership into high, medium, and low Math ACT groups was determined by a cutoff scoring system that produced group sizes that were as close as possible to

equivalent. A Chi-Square analysis was conducted that examined Math ACT Group and Years of Teaching (1 or 2 years) controlling for Training (training vs. no training) on withdraws. The results indicated that for GTAs who were trained a significant relationship existed for YEARS by MACT group on course withdraws, $\chi^2(2) = 7.472, p = 0.024 < .05$. GTAs who had been trained and who were in their second year of teaching had fewer students withdraw from the course. However, the results of the Chi-Square analysis for GTAs who were not trained found no differences between the number of years that they had been teaching by MACT group, $\chi^2(2) = 0.170, p = 0.948 > .90$. These results indicated that GTAs who had been trained and were in their second year of teaching had significantly fewer withdraws from their courses (see Table 2).

Table 2
Frequency of Withdrawals by Training Group, Year and MACT Group

	Training Group					
	Trained			Not Trained		
	MACT Group			MACT Group		
Year	High	Medium	Low	High	Medium	Low
1	82 (30.9)	78 (29.4%)	46 (17.4%)	46 (11.4%)	64 (15.8%)	44 (10.9%)
2	13 (4.9%)	25 (9.4%)	21 (7.9%)	76 (18.8%)	107 (26.4%)	68 (16.8%)

Discussion

According to the 2000 CBMS survey, college algebra has grown to the largest enrollment of any credit bearing mathematics course, approximately 400,000 students in fall 2000. This total was approximately equal to the combined enrollments in all calculus courses. With this large and growing enrollment, mathematics faculty members are collaborating at national conferences, regional conferences, and in individual departments to address issues in college algebra.

Educators from 27 states met in a Conference to Improve College Algebra held at the U. S. Military Academy, West Point, NY in February 2002. The conference was sponsored by the Mathematical Association of America's task force on first college-level mathematics courses. Reporting on the conference, Small (2002), prefaced his comments with current research statistics regarding college algebra. Small found FDW rates for college algebra, (i.e., percentage of students receiving grades of F or D or withdrawing) in the 40 to 60% range and that these rates are generally accepted as typical. "Thus, college algebra blocks academic opportunities and plans for approximately 200,000 students per semester. Participants agreed that we should not accept this constraint of human potential or ambition" (Small, 2002).

Mathematics departments at colleges and universities have an obligation to investigate concerns in college algebra. With so many students affected, priority status should be given to collaborative endeavors to make improvements in college algebra based on solid research. The present study provides important quantitative data to lend support to these efforts.

While reviews of the literature suggest that training and supervising GTAs increases their acquisition and use of effective teaching behaviors (Abbott, Wulff, & Szego, 1989; Nyquist & Wulff, 1996), none of this research examines the effects of such programs on the academic performance of their students. Previous studies have called for more research to assess the effectiveness of GTA training (Abbott, Wulff, and Szego, 1989) and specifically to examine the effects of specialized departmental training (Shannon, Twale, and Moore, 1998). This study provides a comprehensive model for training and supporting mathematics GTAs at the departmental level, and analyzes quantitative data about student performance in college algebra courses taught by GTAs.

The most salient result of the present study pertained to withdraws from college algebra. GTAs with two years of training and two years of experience had significantly fewer students withdraw from their courses than GTAs in their first year of teaching or GTAs that were not trained. Of the students who withdrew from college algebra, only 8.8% withdrew from classes taught by GTAs who were trained and in their second year of teaching. Noteworthy in the present study is the fact that success in lowering the drop rate in the treatment group occurred when students were drawn from the same pool, exposed to the same content at the same pace, and followed the same placement scheme as students in the control group. In addition, the design of the research had controls in place to extract any influence of prior math knowledge.

It appears that GTA training and experience play an important role in keeping students in college algebra. This may explain why course grades were not significantly affected by GTA training and experience. Had these students withdrawn from the course, the resulting course grades may have been higher. It may be possible that GTAs with two years of GTA training and experience help students feel more confident in their ability to perform and persist in algebra. Findings of this study indicate students in the treatment group remain in class and complete college algebra.

Based on the findings for this research study, it appears there is support for mathematics departments at colleges and universities to put resources toward two year GTA professional preparation programs in an effort to improve student outcomes in college algebra. The program and procedures of the GTA training model in this study, and implemented by the mathematics department, included two critical components worthy of further discussion.

First, release time was given to an experienced, tenure-track faculty member for the assignment of overseeing the graduate assistants and the mathematics courses below the level of

calculus. This commitment of time and resources by the mathematics department at this university demonstrated the value they placed on addressing issues in college algebra. Release time was vital because the job of acting as a first responder for graduate assistants and their students can be time consuming; this is largely due to the fluid environment created by the hundreds of students taking these courses and the inexperience of their teachers. The position of faculty GTA supervisor can be crucial for a department that employs GTAs to teach. As evidenced by the results of the present study, the payoff for the department appears to be improved student success rates in the classes taught by GTAs. With support, the necessary release time and resources, the faculty GTA supervisor can also be an invaluable resource for a department to share information about current research in the fields of college student learning and development, pedagogical techniques specific to undergraduate mathematics education, and graduate teaching assistants' needs.

Second, under the GTA training program for the treatment group in this study, a new course, MATH 871 Teaching Mathematics, for one-credit-hour was added and required of all GTAs. Graduate students teaching in the mathematics department met for a half day of professional development training before the fall semester began and then for a one hour class each week throughout the semester. The curriculum for MATH 871 Teaching Mathematics was designed specifically to assist GTAs in their role as educators and to address the unique professional challenges and limitations they face.

These two components, a supported faculty GTA supervisor position and a course for GTAs about teaching college mathematics, provided the structure for the improved student outcomes that were observed in the present study. It seems that when the structure is in place for

GTAs to receive support, guidance, and resources for teaching, they then in turn provide the structure for students to receive support, guidance and resources for learning.

In the final analysis, a well-planned program of support and professional development for graduate students in the role of teaching assistants combined with experience appears be a major factor in improving academic outcomes for students in college algebra. The beneficiaries of the program are both graduate assistants and the hundreds of undergraduate students they teach each semester.

For graduate assistants, most go on to teach in some capacity: in graduate teaching assistantships while working on doctorate degrees, in community colleges, and in high schools. Their successful teaching experience and course credit in teaching mathematics makes them desirable candidates for these positions. For those whose career paths don't take them into the academic world, the communication skills inherent in teacher training helps them be more effective spokespersons in their profession.

For many undergraduate students, college algebra is their only contact with the mathematics department at their colleges or universities. They stand to gain the most by having teachers who are prepared and supported in their teaching endeavors. The department, and the university as a whole, benefits by the cyclical nature of a program of training and support for GTAs that facilitates positive results and contributes to improved drop rates in college algebra.

To be sure, addressing the issues with college algebra is an arduous task involving many variables and certainly more than one solution. Collaboration with members of the college community about ways to address concerns and solutions about college algebra, including GTAs teaching college algebra, should be an ongoing endeavor.

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