University of Tennessee, Knoxville

TRACE: Tennessee Research and Creative Exchange

Doctoral Dissertations

Graduate School

12-2008

A Comparative Study of Faculty Expectations of New Hires in Mathematics Education and Qualifications of Doctoral Students in Mathematics Education

Randy L. Collins
University of Tennessee - Knoxville

Follow this and additional works at: https://trace.tennessee.edu/utk_graddiss

 Part of the Education Commons

Recommended Citation

Collins, Randy L., "A Comparative Study of Faculty Expectations of New Hires in Mathematics Education and Qualifications of Doctoral Students in Mathematics Education. " PhD diss., University of Tennessee, 2008.
https://trace.tennessee.edu/utk_graddiss/490

This Dissertation is brought to you for free and open access by the Graduate School at TRACE: Tennessee Research and Creative Exchange. It has been accepted for inclusion in Doctoral Dissertations by an authorized administrator of TRACE: Tennessee Research and Creative Exchange. For more information, please contact trace@utk.edu.

To the Graduate Council:

I am submitting herewith a dissertation written by Randy L. Collins entitled "A Comparative Study of Faculty Expectations of New Hires in Mathematics Education and Qualifications of Doctoral Students in Mathematics Education." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.

Vena Long, Major Professor

We have read this dissertation and recommend its acceptance:

JoAnn Cady, P. Mark Taylor, Chuck Collins

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a dissertation written by Randy L. Collins entitled "A Comparative Study of Faculty Expectations of New Hires in Mathematics Education and Qualifications of Doctoral Students in Mathematics Education." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.

Vena Long

Major Professor

We have read this dissertation
and recommend its acceptance:

JoAnn Cady

P. Mark Taylor

Chuck Collins

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

A Comparative Study of Faculty Expectations of New Hires in Mathematics Education and Qualifications of Doctoral Students in Mathematics Education

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Randy L. Collins
December 2008

ACKNOWLEDGEMENTS

"The brick walls are there to give us a chance to show how badly we want something." Randy Pausch (The Last Lecture)

There have been many brick walls in my way. I would like to acknowledge all those whose support and encouragement made it possible for me to scale those brick walls. Without these people I would not have made it. First, I want to thank my family and friends for their constant encouragement. My mother was always encouraging thoughout this process. My father is in the final stage of Alzheimer, but I know if he was of right mind he would have words of encouragement also.

A special thanks also goes to Bob. Bob supported me emotionally and financially so that I could continue my degree after I took a 3 year break in 2002. His calls and emails to ask where I was in the process helped keep me on track. I will always love you.

I owe a great deal of thanks to Joellen and Dan, my accountability partners. We spent many nights in the library and at Panera's. Without them I am not sure I would have finished. A very special thanks goes to Joellen. She was my editor. She would read over my work and be critical and harsh at times but yet it forced me to be a better writer. She was my slave master. When I did not feel like working, she forced me to work. She sat with me at Panera's, even when she had finished her dissertation to make sure I was working. For your constant support, I am truly grateful.

During my program I have met wonderful people and was able to work with them. So, I want to thank Tommy, Geri, and Yan for their collaboration on presentations

and help with research projects. There are many more friends that helped me. Val, I want to say thank you for your words of support. Also the words of support from Adam helped me along this journey.

There have been many faculty that helped me throughout this process and gave me valuable experiences. I was able to work on research under the direction of Dr. Cady. I thank you for that opportunity and the resulting presentation and publication that resulted of that study. Dr. Hopkins showed me how to plan and teach a methods course. Dr. Taylor always took time to talk to me and gave me words of encouragement even during my darkest times. Dr. Collins showed me the value of excellent teaching.

I started taking graduate classes in mathematics education in May 2000; that is when I first met Dr. Vena Long. She always encouraged and challenged me and I thank her for that. When I came back in 2005, Dr. Long always made it possible to experience the beyond course experiences I write about in my dissertation. I cherish your mentorship.

ABSTRACT

There is a critical need to attract more students into doctoral programs in mathematics education. Those in the doctoral programs in mathematics education have many career options outside of academics and research shows that 20% of those seeking the doctorate in mathematics education go into other areas besides higher education (Glasgow, 2001). Thus, there has been a shortage of qualified applicants for academic positions (Reys, 2000; Glasgow, 2000; Reys & Kilpatrick, 2001; Reys, 2002). Complicating matters is the fact that 80% of faculty in mathematics education are eligible to retire in 2008 (Reys, Glasgow, Ragan, & Simms, 2001; Reys, 2006). Thus, it is important to study faculty's expectations of new hires and doctoral students' experiences to allow for maximum success of those seeking positions in higher education.

The purpose of this study was to compare data received about the training of current doctoral students with data collected from the profession to see if there is a match or disconnect between the two groups (i.e. doctoral student's training and requirements for new hires in mathematics education). The data came from a combination of mail and online surveys along with e-mail interviews. Frequency counts and descriptive statistics were used to provide a clear picture of the experiences doctoral students were being exposed to in their doctoral program and the faculty's expectations of qualified candidates for a junior faculty position. A MANOVA test was used to see if any differences occurred between the two groups. The findings of this study suggest doctoral students were for the most part being properly socialized to take on the role of an assistant professor; however, there were some areas of weakness.

PREFACE

My interest in this topic for my dissertation grew out of readings I was exposed to both in and outside courses I had during coursework of my doctoral program. There were three articles in particular that inspired me to research this topic, all of which were written by Dr. Robert Reys. The first article was "Doctorates in Mathematics Education-An Acute Shortage" (Reys, 2000). The next article was "Mathematics Education Positions in Higher Education and Their Applicants: A Many-to-One Correspondence" (Reys, 2002). The third article was "A Report on Jobs for Doctorates in Mathematics Education in Institutions of Higher Education" (Reys, 2006). I was particularity drawn to Reys' 2006 article in which he provided information on the current state of open higher education positions in mathematics education. One finding of his study was the apparent disparity between the applicants' qualifications and job responsibilities.

Based on Reys' study, I started an investigation to look at the hiring preferences of institutions when evaluating potential candidates in mathematics education. My goal was to complete that study and then survey doctoral students to see if they are getting the experiences that is needed to fill positions in mathematics education. Due to a series of unfortunate events the study about what faculty looks for in potential new hires never was completed. Thus, this dissertation became a blend between the original failed study involving faculty members and now data collected about doctoral students' experiences. This study sought to compare the two groups (doctoral students and faculty in mathematics education).

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

CHAPTER I

INTRODUCTION

> *Golden lion tamarins, Siberian tigers, and doctorates in mathematics education share some common properties. While none are extinct, each is in short supply and in high demand* (Reys, 2000, p. 1267).

Chapter Introduction

The field of mathematics education is a fairly new field of study as compared to its counterpart, mathematics. The 1890s saw the birth of the field, but it was not until 1912 that mathematics education was seen as an area of study distinct from mathematics (Donoghue, 2001). With the nearing of 100 years, the field has seen many accomplishments and groundbreaking research in the area of learning and teaching mathematics; however, what it means to have a doctorate in mathematics education and what is needed for the profession are still matters of debate.

According to Reys and Kilpatrick (2001), the doctorate in mathematics education is ambiguous since the profession is a composite of liberal arts and education. Mathematics is viewed as a science and education has its grounding in sociology. Therefore, mathematics education suffers from a lack of a clear, articulated identity (Reys, 2000). Even with these uncertainties about the profession, the demands for and roles of those with doctorates in mathematics education appears to be expanding (Reys, 2000). The job possibilities are numerous for those possessing a doctorate in mathematics education. Thus, the coining of the phrase "one field, many paths" (Reys & Kilpatrick, 2001). Some take positions in higher education, while others go back to the K-12 classroom. Some are drawn to government agencies, while others go to the private

sector. With the growing job market for those with doctorates in mathematics education, the demand exceeds the supply (Reys, Glasgow, Ragan, & Simms, 2001 Reys, 2002; Reys 2006; Castle & Arends, 2003; Twombly, Wolf-Wendel, Williams, & Green, 2006). Hence, institutions of higher education have critical difficulties in filling academic positions.

In addition to multiple definitions of the doctorate in mathematics education, the job qualifications at one institution may or may not be the same as at other institutions. For example, some positions require teaching both education and mathematics classes, which requires a rigorous mathematics background while other positions are more focused on teacher preparation. Likewise, not all doctoral programs are equal. Reys, Glasgow, Ragan, & Simms (2001) point out that some doctoral programs consist of a large number of mathematics courses with some graduate education courses, while other programs offer more of a balance between mathematics and mathematics education courses yet others require no mathematics courses at all. Some programs use a mentor program that allows graduate students to participate in actual research projects while other programs only offer pseudo-research opportunities through coursework. As a result, someone from one university will not have the same qualifications and experience as one from another university thus limiting and confounding the number of qualified doctorates for the every expanding job market. Hiebert, Kilpatrick, & Lindquist (2001) summarized the issue:

> The absence of system-wide standards for doctoral programs is, perhaps, the most serious challenge facing systemic improvement efforts….participants in the system have grown accustomed to creating

> their own standards at each local site. …Currently, the standards of individual programs can vary widely. This creates a problem for system-wide improvement because if different programs are working toward different goals or standards, then what is learned at one site is of little use at other sites (p.155).

The "non-standardized" doctoral programs in mathematics education have an effect on institutions hiring faculty members qualified to meet the demands at their institution. For example, Reys (2002) surveyed 134 positions with each position having an average pool of applicants between two to ten. Forty-nine percent of these positions were not filled. In a more recent article, Reys (2006) provided updated information on the current state of open higher education positions in mathematics education. One implication of his study was the apparent disparity between the qualifications needed for the position and job responsibilities. In the same study, Reys's research showed that approximately 40% of the open positions in mathematics education went unfulfilled for the 2005-2006 academic year. Of the thirty-seven positions in mathematics education that were not filled, ten institutions cited "no appropriate applications" (pg. 266). When positions were filled, half were filled with new graduates of doctoral programs in mathematics education. Thus, the training these new hires received in their doctoral program has an impact not only on their success in becoming faculty members but also the success of the profession.

Open positions in mathematics education often fail to attract enough qualified applicants (Schuster, 1995; Reys, 2002; Reys, 2006; Castle & Arends, 2003). Castle & Arends (2003) found 62% of potential new hires applying for an open position did not

meet the requirements for the position being offered. Furthermore, Castle and Arends indicated that mathematics education had 128 positions opened yet the average number of applications per opening was 12. This is similar to Reys's (2006) research that indicated the average number applying to doctoral granting and 4-year institutions was 14 applicants per open position. This limited number of applicants combined with a lack of qualified applicants can lead to positions not being filled or filled with less than ideal candidates.

Much of the research has focused on the shortage of candidates graduating with a doctorate in mathematics education, not on what universities seek in new hires. Twombly, Williams, & Green (2006) conducted a study of job postings and job requirements for applicants for open positions in education positions in higher education from Fall 2001 until Spring 2002. Their study included all positions for teacher educators (n=1039). The study identified the top three requirements of all job applicants: possession of a terminal degree (84.3%), teaching experience at the K-12 level (65.0%), and being capable of conducting research or having research experience (24.9%).

The shortage of doctoral students in mathematics education has been well documented. However, the nature of their academic preparation is less clear. This study sought to supply information about how doctoral students in mathematics education are being prepared for faculty positions. This information will be compared with data received from universities on the qualifications they look for in a new hire in mathematics education. This study is of importance given the current state of the supply and demand of mathematics educators.

Problem Statement

For at least the past decade there has been a shortage of qualified applicants in mathematics education, which mirrors the shortage of public school teachers in mathematics (Reys, 2000; Glasgow, 2000; Reys & Kilpatrick, 2001; Reys, 2002). With many entry points into the profession and many employment opportunities outside of academia, institutions of higher education have limited pool of candidates for open positions as assistant professors. Glasgow (2000) found that 20% of 200 graduates with doctorates in mathematics education surveyed were not in positions at universities and colleges.

On top of the already thin supply of qualified applicants in mathematics education, many of the current faculty members are nearing retirement age. Eighty percent of faculty in mathematics education will be eligible to retire by 2008 (Reys, Glasgow, Ragan, & Simms, 2001; Reys, 2006). The profession needs up and coming scholars to continue the work and research to keep the field viable. The current doctoral programs must be studied to see if preparation is a factor in meeting the demands of the field.

Purpose of Study

Are doctoral students being properly prepared for the demands and needs of faculty positions? Research must be conducted on the training students receive in doctoral programs to determine if these qualifications match what is needed by the profession. Thus, the purpose of this study was to compare data received about the training of current doctoral students with data collected from the profession to see if there

is a match or disconnection between the two groups (doctoral student's training and requirements for new hires in mathematics education).

To investigate the training of doctoral students in mathematics education along with qualifications that universities are looking for, a sequential mixed methods study was conducted (Creswell, 2003). The majority of data were collected through surveys. In order to gather deeper knowledge, doctoral participants in the study were given an opportunity to supply further information though a structured interview conducted by e-mail.

Assumptions

For the purpose of this study the following assumptions were made:

1. Subjects will respond to the best of their ability and with honesty to the instrument administered.
2. The instrument used provides adequate data for comparisons to be made between faculty's expectations and doctoral students' educational background and beyond course experiences.
3. The analysis will be comprehensive and the findings correctly described.

Limitations

Convenience sampling was used in this study since faculty and doctoral students were selected from the Association of Mathematics Teacher Educators (AMTE) website (www.amte.net). The proposed sampling procedure can bias the results of the study and prevent findings from accurately describing the entire population (Ott & Longnecker, 2001). Thus, this study could not be used to accurately describe all doctoral students and

programs in mathematics education. Rather, only statements about the doctoral programs listed on the AMTE website can be assessed; however, the universities listed on the website produce most of the doctorates in mathematics education. Many of the participants were from research intensive institutions, which also narrowed the scope of this study.

Delimitations

This study was limited to full-time and part-time doctoral students in programs listed on the Association of Mathematics Teacher Educators (AMTE) website in the spring of 2008. Participation was also limited to one full-time university faculty in mathematics education at each institution listed on the AMTE website. The contact person listed on the website was assumed to be knowledgeable about the doctoral program in mathematics education at that institution and the qualifications their department seeks when they hiring for a mathematics education position.

Appendix A shows a table of institutions listing their doctoral program in mathematics education on the AMTE website. Most institutions are public institutions, thus further limiting the scope of this study. These delimitations will affect the generalizability of the findings.

Research Questions

The overarching research question was the following: *How are programs in mathematics education preparing their doctoral students to meet the demands of the profession?* To answer this question, sub-questions were investigated for faculty and doctoral students. For faculty, the sub-questions were: 1) *What educational and beyond-*

course experiences do faculty members value in the hiring process of potential new hires in mathematics education?; and 2) *What qualifications do faculty in mathematics education value in preparing doctoral students at their institution?* For doctoral students, the sub-questions were: 1) *What educational and beyond-course experiences have doctoral students participated in during their current doctoral program?*; and 2) *What do doctoral students perceive as valuable educational and beyond course experiences in the hiring process for a position as a faculty member in mathematics education?*

Theoretical Framework

The framework of socialization was used as the theoretical perspective for this study. This framework focuses on how doctoral students are socialized into the profession. Socialization is the development of individuals (i.e. doctoral students) in which they learn to develop the values, attitudes, skills, and knowledge needed for membership in an organization (i.e. assistant professor of mathematics education) (Merton, 1957; Tierney, 1997).

Tierney (1997) states that activities of an organization create shared meaning. In order for new individuals to be successful in an organization they must understand and participate in those activities. Thus, it is important for doctoral students to imitate activities carried out by faculty in mathematics education so that they can learn what is needed for the profession. When individuals wish to enter a doctorate program in mathematics education, they start at the anticipatory socialization stage. The anticipatory socialization takes place in graduate school. Students begin to shape their professional attitude and beliefs through coursework, interaction with professors, and other students in

the program (Boyer, 1990). By definition, anticipatory socialization is the period of time when doctoral students take on the values and norms for the organization to which they wish to aspire (Merton, 1957; Tierney & Rhoads, 1994). Once an individual enters an organization, they experience the role continuance stage. At this stage individuals go through the socialization stage that will influence their decision to stay in the organization and take on the norms and values of the organization (Tierney & Rhoads, 1994). The anticipatory stage is represented by the doctoral students who wish to obtain a doctorate degree in mathematics education. The role continuance stage is represented by the faculty members in mathematics education.

Definition of Terms

Potential New Hires

Potential new hires for this study are defined as doctoral candidates searching for a position in mathematics education at higher institutions.

Beyond Course Experiences

Blume (2001) defines beyond course experiences as non-course experiences of doctoral students in teaching, research, scholarship, and professional development that may be formal or informal.

Sequential Mixed Method Study

Creswell (2003) defines a sequential mixed method study as a study used to elaborate on or expand the findings of one method through the use of another method. This study began with a survey and was followed by an interview, which involved an exploration of a few doctoral students in mathematics education.

Carnegie Classification

The Carnegie Foundation classifies doctorate-granting universities, which graduates at 20 graduates per year, in three categories: RU/VH: research universities (very high research activity), RU/H: Research University (high research activity), and DRU: Doctoral/Research University. The Carnegie Foundation website (www.carnegiefoundation.org) website was used to lookup the institution for this study.

Organization of the Study

This study is organized into five major chapters. Chapter I consists of an introduction, the statement of the problem, the purpose of the research, the importance of the study, assumptions, limitations, definitions of important terms, and the organization of the study. Chapter II consists of a review of the related literature which provides the background information and basis for the study. Chapter III identifies and explains the methods and procedures what will be used for data collection and analysis. Chapter IV consists of the presentation and analysis of the data. Chapter V consists of a summary, major findings and conclusions of the research, implications, and recommendations for further research.

Summary

This study looks at the preparation of doctoral students in mathematics education in light of the qualifications institutions seek in new hires. A shortage of doctoral students in mathematics education along with a rapidly retiring faculty in mathematics education makes this research topic very timely and crucial. A lack of candidates tells one side of the story, but a lack of qualified candidates may bring the preparation of

candidates into question. This study looks at the results of the educational background and beyond-course experiences through the perception of doctoral students and compares their data with the qualifications faculty looks for as they select new colleagues.

CHAPTER II

Literature Review

Chapter Introduction

Doctoral education in the United States began during the late 1800s (Golde & Walker, 2006). Almost since the establishment of the Ph.D. in the United States, questions have been raised about the purpose of the doctorate. Many research studies have been conducted about doctoral education over the years; however, studies about doctoral students experiences and their preparation for future careers were not a focus until the 1990s (Borkowski, 2006).

The early research studies about the doctoral students' experiences and preparation did not focus on mathematics education. The first comprehensive look of the field of mathematics education was not truly studied until 1999 with the Conference on Doctoral Programs in Mathematics Education held at the University of Missouri. The conference included discussions regarding the characteristics of current doctoral programs in mathematics education, as well as critical issues facing these programs. This conference and the research that preceded were needed in light of shortage of doctoral students in mathematics education and the fact that a large portion of the current faculty is nearing retirement age (Reys & Kilpatrick, 2001).

In order to lay the groundwork for this study, literature with respect to the history of the doctorate both in general, and then, specifically in terms of mathematics education was reviewed. Next, research was reviewed about the supply and demand, career preparation, and new hires of those of faculty. Much of the research on faculty supply

and demand, doctoral programs, and research on new hires in higher education were not subject specific. Next, information about the future of doctoral education via the work of the Carnegie Initiative on the Doctorate (CID) was reviewed. Finally, information about socialization theory was reviewed.

History of the Doctorate Degree

In order to understand the doctorate degree better one must understand how the current system came to be. During the 1800s those wishing for advance degrees in the United States had to travel to Europe--mainly Germany (Walker, Golde, Jones, Bueschel, & Hutchings, 2008). When graduate education established itself in the United States during the 1800s to 1930s, the programs took many of the German models features--mainly an emphasize on scientific inquiry and expectation that faculty will conduct research (Walker et. al, 2008). In 1876, John Hopkins University paved the way for the research-oriented Ph.D. in the arts and sciences. John Hopkins University also established fellowships to support students wishing to complete Ph.D. degrees (Walker et. al, 2008). Soon other universities followed with each university establishing requirements for doctoral study, which was set by each university's graduate faculty (Walker et al., 2008).

Initially in establishing doctoral education in the United States, a single national university was suggested but this recommendation was never implemented. Thus each university set their own standards and requirements (Walker et al., 2008). These early programs laid the foundation for most graduate school functions today. An example of the early programs had paths similar to this:

> After completing an undergraduate degree, the prospective student applied for admission and entered a community devoted to research and scholarship; participated in graduate seminars (a format developed for graduate education) as well as more informal, individualized teaching arrangements; passed examination in two foreign languages (usually French and German) as well as a comprehensive examination (which many students failed); and concluded his studies by submitting a written thesis for approval by a committee of faculty members (Walker et al., 2008).

Those completing the doctorate saw their career tied to academics, thus establishing a cycle of professional preparation which we see today, faculty preparing students to become future faculty members (Thelin, 2004).

Even during the early stages of the development of the Ph.D. in the United States, a concern about the quality and purpose of graduate education emerged. Thus, in 1900 the Association of American Universities (AAU) was developed to open the communication between universities about common areas of interest in graduate study (Walker et al., 2008). Early on, the faculty was concerned about resources to expand graduate education. The balance between research and teaching was an ongoing concern. In fact, the issue of how much researchers (i.e. faculty) should be relieved of their teaching duties became a focus issue of the AAU in 1906 (Walker et al., 2008).

The 1940s through 1960s was a major period of growth for doctoral education in the United States. After World War II more middle class and working class students began undergraduate education (Walker et al., 2008). Before, those in undergraduate and

graduate programs were white, upper class males. To meet the need of this major influx of students, universities expanded graduate education in part to produce more future faculty to fill the great demand. During this time that federal funding became a major part of universities. The National Science Foundation, National Institutes of Health, and National Defense Education Act were established, which funded faculty research and supported graduate students (Walker et al., 2008).

With the additional funding, the number of graduate students tripled between 1960 and 1970 (going from 10,000 to 30,000) (Walker et al., 2008). During this period, graduate students were given more responsibilities for research and teaching (Walker et al., 2008; Thelin, 2004). This expansion resulted in completion times going from two years to five years (Walker et al., 2008).

During the 1970s federal funding declined and the academic job market leveled off, resulting in a lesser need to produce future faculty. However, students continued to enter doctoral programs (Walker et al., 2008). New questions surfaced about whether enrollment in doctoral programs should be limited, and about the quality of students. In order to address these questions, the National Board on Graduate Education was formed to investigate graduate education.

The National Board on Graduate Education recommended that programs be offered to part-time and older students with a goal of alleviate some funding issues and to attract more professionals into doctorate education (Walker et al., 2008). The board also suggested that a focus in careers of college teaching, rather than research, be offered to doctoral students. This new degree, doctorate of arts (DA), was formed. The primary focus of the DA degree was to educate college teaching (White & McBeth, 2003). The

DA failed to gain popularity perhaps because graduates with Ph.D.s had more careers options (White & McBeth, 2003; Walker et al., 2008).

During this time period, students began voicing their concerns about their experiences in doctoral programs. One study revealed one third of the students dropped out because the requirements of the degrees were too constraining (Walker et al., 2008). Through studies as these some doctoral programs changed their requirements such as when comprehensive exams were given and the language requirements (Walker et al., 2008).

The 1980s and 1990s saw a change in the student demographics, with doctoral education opened fully to females and with more international students attending graduate school in the United States (Walker et al., 2008). However, what failed to occur and has been a persistent problem is attracting minorities to graduate education. The 1990s saw new fields appear, an increase in doctoral students due to the retirement of faculty, and a move to non-academic career paths. Through the history of graduate education in the United States a constant concern has been the purpose of graduate education and whether or not graduate education is meeting the needs of the current and future students.

History of the Mathematics Education Doctorate Degree

Early doctoral programs in mathematics education were started at Teachers College, Columbia University, and the University of Chicago. These early programs were interested in training faculty to teach college and secondary mathematics (Donoghue, 2001). The coursework included many upper level mathematics courses,

general education courses, courses on the learning and teaching of mathematics, and history and philosophy of education classes (Donoghue, 2001). The programs involved training teachers not researchers.

In the 1950s and 60s a focus on the research aspect of mathematics education, became prominent. The Sputnik era resulted in government funding to improve school mathematics (Sowder, 1989). Colleges of education and departments of curriculum and instruction were further developed to move beyond the preparation of teachers to research school mathematics teaching and learning. Doctoral education began preparing scholars to contribute to the field through research, service and teaching (Boyer, 1990). The change from producing teachers to producing researchers turned mathematics education into a field of scholarly activity (Boyer, 1990).

The 1999 Conference on the Doctoral Programs in Mathematics Education, brought new attention to doctoral programs and students. The increased need for doctoral programs to meet the demand of the today and future caused leaders in the field to reevaluate their programs. This is especially true in light of the shortage of doctoral students in mathematics education, the ever expanding non-academic career options available, and the fact that many current faculty in mathematics education is nearing retirement age (Reys et al., 2001).

Beyond Course Experiences

The 1999 Conference on the Doctoral Programs in Mathematics Education identified a new area of interest, beyond course experiences. Coursework, comprehensive exams, and the dissertation are not the only components of doctoral

programs. Beyond course experiences, make a "substantive contribution" (Blume, 2001, pg. 87) to student's doctoral study. In fact, Blume goes on to state that beyond course experiences should not be treated as an elective but as a requirement for doctoral programs. It is important that doctoral programs design beyond course experiences so they complement coursework and to approximate the roles and responsibilities of mathematics educators (Blume, 2001).

During the conference, participants were able to list beyond course experiences they felt were important. Beyond course experiences that participants felt important included:

- Mentored teaching of mathematics
- Mentored teaching of courses on the teaching and learning of elementary or secondary mathematics
- Design of a course or development of curriculum materials
- Mentored supervision of preservice teachers' field experiences
- Development of a broad-based reading list that completely addresses the field of mathematics education
- Mentored conceptualization, conduct, and reporting of research
- Developing writing expertise through submitting articles to practitioner and research journals
- Oral presentation and defense of one's scholarly work
- Service as a referee or an editorial assistant for a professional journal
- Interaction with a local scholarly community
- Interaction with the broader mathematics education scholarly community

- Design, conduct, and assessment of long-term inservice or professional development activities for teachers (pp. 88-89).

Blume sees a need for research into the beyond course experience particularly in two areas: the beyond course experiences doctoral students receive and the benefits of those experiences. Blume writes:

> The first area includes questions related to the nature and extent of mathematics education doctoral students' engagement with non-course experiences [NCEs]. For example, how much of a typical doctoral student's program consists of what might be categorized as NCEs? Across doctoral-granting institutions what types of NCEs are most common? Which NCEs are required, and which are optional in students programs? What is the relationship between the nature of students' career goals and the NCEs in which they ought to engage? (p. 90)

With the second area, Blume poses this question "Which NCEs are most useful to students purposing particular career paths?" (p. 90). The issues and questions have been identified but little research has been done.

Research Studies

This section presents background research studies on faculty. First, a review of literature about the supply and demand of doctorates was reviewed. Next, the career preparation of doctorates was reviewed. Finally, the literature on the new hires was reviewed. For these categories, Most of the research studies are not subject specific.

Supply and Demand

Doctorates in Mathematics Education are in short supply but high demand (Reys, 2000; Reys, 2002; Glasgow, 2000). The NRC released data from 1980 to 1998 on the number of doctorate degrees awarded in mathematics education. Their data showed that 1,386 doctoral degrees in mathematics education were awarded from 1980 to 1998 (NRC, 2000). Reys (2000) reveled that the number of doctoral degrees awarded ranged from a low of 50 in 1980 to a high of 115 in 1998.

Reys (2000) points out there are many factors that affect the supply and demand. For example, a new trend of the teaching and learning of undergraduate mathematics is creating a need to have faculty in mathematics education focus more on research in mathematics departments. There are also more job opportunities in large school districts. The pay in those districts could be a factor since Reys (2002) found that the salary range of assistant professors is normally between $40,000 and $45,000.

In the 2000 to 2001 academic year Reys (2002) found that there were 134 open positions in mathematics education, which far exceeds the average number of graduates per year. Research shows that about 30% of those that have received a PhD were already employed (Reys, 2002, Glasgow, 2000). They are on leave from their position to complete their doctorate degree. Another 20% either leave the United States (especially international students) or take positions with companies or government agencies; thus, only about half of graduates actually apply for open positions in mathematics education.

Glasgow's (2000) research showed that more students (42%) accepted positions as Master's level colleges and universities than any other type of institution. Eighteen percent took positions at Research I college and universities, 20% at doctoral level

colleges and universities, 10% at Baccalaureate college and universities, and 10% Associate of Arts colleges). Graduates took positions at Master's level colleges and universities because: 1) they were already employed there; 2) they had a strong desire to teach mathematics; and 3) desire to spend time teaching and doing professional development instead of focusing on research (Glasgow, 2000). Sixty percent of those that took positions were in departments of mathematics with 32% taking positions in colleges of education (Glasgow, 2000).

Career Preparation

Data shows many doctoral students wish to obtain faculty positions. Data was collected from a survey of 27 universities in 11 arts and science fields. From the survey 63% said they was interested in becoming faculty members, with 48% saying they were definitely seeking faculty positions (Golde & Dore, 2001). In another similar study, Nettles and Millett (2006) found that 38% of doctoral students in education wished to become college or university faculty members. One reason for this low percent may be the fact that many doctoral students in education attend on a part time basis and thus wish to keep their career after completing their degree. The degree is more for salary enhancement and advancements at their current job than for pursuing research or a research related position.

In Golde and Dore's (2001) survey, participants responded to questions of how well they were being prepared to take on faculty positions. Of those that were interested in faculty positions, 74.2% were interested in conducting research. In fact, doctoral students reported that 65% were trained on how to conduct research and 45% of those

surveyed were actually allowed to conduct their own research (Golde & Dore, 2001). The participants responded that 85% of them were able to present at conferences. Golde & Dore (2001) found that although there was interest in conducting research and presenting papers, only 44% said they were properly prepared to publish original work. Since publishing is usually a requirement to obtain tenure in higher education, Golde and Dore expressed their disappointment in the fact that less than half of the students had any form of training on publication.

Nettles and Millett (2006) speak of research productivity, which they define as presenting research papers or posters at conferences, publishing a journal article, publishing a chapter in an edited book, or publishing a book. Nettles and Millett stated that doctoral students who are research productive during their doctoral experience will stand out when entering the labor market.

Most of the knowledge of doctoral students' research productivity comes from dissertation studies (Nettles & Millett, 2006). From their study, Nettles and Millett found that about 40% of doctoral students in education indicated some type of research productivity as compared to 51% of doctoral students in general. Thirty percent of those doctoral students in education studied presented a research paper at a professional conference either as the sole or joint author. Nettle and Millett point out that some did a poster session instead of a research presentation. Fifteen percent of doctoral students in education published an article, which Nettel and Millett indicated in the field of education is a "highly prized accomplishment" (p. 110). The percentages were low for doctoral students publishing a book or write a chapter in an edited book (4% for book and 10% for writing a chapter in an edited book).

A four-year longitudinal study was conducted to see if the training of doctoral students was properly preparing them (Nyquist, Austin, Sprague, & Wulff, 2001). Their research found four areas in need of improvement. First, they found a lack of proper training on how to conduct classes and deal with classroom management issues. Secondly, doctoral students reported a lack of feedback and mentoring. Thirdly, students felt they were not being trained on the job market and opportunities. Finally, they concluded that there were discrepancies between the doctoral program and the demands of the profession.

The National Association of Graduate and Professional Associates (2001) conducted a survey of 32,600 doctoral students at 399 universities. From the study, survey responders were generally positive about their program. In fact, 75% of participants reported they were satisfied with their educational experience. The biggest complaint dealt with a lack of information about the job market and employment opportunities (63%).

New Hires in Education

Studies show that new hires in higher education are often not properly prepared for the position (Trower, 2001; Sorcinelli, 2001). Trower (2001) found new hires were often unfamiliar with tenure or the tenure process. Plus, many new faculty members face stress from heavy teaching loads, developing new courses, and serving on committees. She noted that many new hires seemed unfamiliar with the various commitments required of faculty members.

Sorcinelli's (2001) study of new hires in higher education revealed three areas in which they felt unprepared or found surprising. First, many reported a feeling of isolation and lack of mentoring. They reported a need for intellectual conversation with other faculty members. Secondly, new hires reported they knew little of the tenure process. Finally, they reported difficulty in balancing the workload with family commitments.

Wilson (2000) studied 42 new hires in their first, second, or third year of employment at small liberal colleges in Ohio. Her findings showed that only 10% were able to keep up with their research agenda. Participants were also surprised by poor academic preparedness of college students, classroom behavior, time required for non-teaching duties such as committees, lack of resources, and inability to work with other faculty members. Only 19% said they experienced a mentoring process during their early years as a faculty member.

Glasgow (2000) studied the activities of those employed as assistant professors of mathematics education. He found an average of 9.5 hours per week was devoted to teaching. Those surveyed reported they averaged 9 publications and 19 presentations over their career. More publications occurred at research intensive institutions than Master's level institutions (21 publications for research and 6 for Master's level). They were also involved in an average of 3 funded projects.

Reforming Doctoral Education

From the history of doctoral education in the United States concerns about the quality and purpose of graduate education have been questioned from the beginning. There have been many efforts to guide the development of doctoral programs including

the AAU and the National Board on Graduate Education (Walker et al., 2008). Currently the Carnegie Foundation for the Advancement of Teaching has been leading efforts to define and improve doctoral programs (Golde & Walker, 2006).

The Preparing Future Faculty (PFF) initiative was started in 1993 with a goal of giving doctoral students opportunities to observe and experience faculty roles (White & McBeth, 2003; Walker et al., 2008). The training of teaching assistants (TAs) became a highly touted reform agenda with the goal of preparing graduate students as teachers (Walker et al., 2008). Re-Envisioning the PhD. was another project focused on helping institutions with their doctoral programs. Their recommendations included better preparation for teaching and better information to students about the requirements and expectations of doctoral education. During the 1990s a document *In Pursuit of the Ph.D.* sparked much attention as it documented the high attrition rate and the lengthening time to degree (Borkowski, 2006; Walker et al., 2008; Lovitts, 2001).

With all of the focus on the attrition rate, length of time to degree, and training future faculty, the Carnegie Foundation for the Advancement of Teaching took on a project in 2001 to help coordinate reform efforts –the Carnegie Initiative on the Doctorate (CID). As part of this effort, the CID sought to answer the question, what is the purpose of doctoral education?

> We propose that the purpose of doctoral education, taken broadly, is to educate and prepare those to whom we can entrust the vigor, quality, and integrity of the field. This person is a scholar first and foremost, in the fullest sense of the term—someone who will creatively generate new knowledge, critically conserve valuable and useful ideas, and responsibly

> transform those understandings through writing, teaching, and application. We call such a person a Stewart of the discipline (Golde & Walker, 2006, p. 5).

The CID views doctorate degrees as a high level accomplishment in three facets: generation, conservation, and transformation (Golde & Walker, 2006). Those with PhDs are researchers and thus after finishing a degree should be capable of conducting research that makes a contribution to the field of study. These same people must be capable of reading and assessing others work to insure scholarly work. Further those obtaining a PhD must conserve the history and tradition of the field. They must have a mastery of the breath and depth of their field of study. The third facet is that of transformation. Those with PhDs must be able to effectively communicate ideas through oral and written forms. These three facets further strengths the view that those obtaining PhDs are Stewarts.

This stewartship can be viewed as the process of caring for and managing their field of study (Golde & Walker, 2006). These Stewarts must consider the "application, uses, and purposes of the discipline and favors wise and responsible applications" (Golde & Walker, 2006, p. 13). Golde and Walker go on to say these Stewarts must know how to prepare the next generation of Stewarts. The CID points out that stewartship is not given to only certain individuals but should be applied to all doctoral students (Golde & Walker, 2006). Stewartship is a set of qualities which can be developed during the doctoral education. The CID points out that the generation aspect of Stewarts have been effectively developed in doctoral education but more work is needed in conservation and transformation (Golde & Walker, 2006). As part of the CID's efforts, they asked

scholars in various fields to consider how they would redo their doctoral programs. When asked Richardson (2006) noted that the field of education is unique in that Stewarts must be responsible for both the field of educational study and the education enterprise.

Richardson further states that in order to prepare Stewarts for the doctorate of education there must be three forms of knowledge and understanding: formal knowledge, practical knowledge, and beliefs including misconceptions. Formal knowledge, as defined by Richardson, refers to knowledge one thinks of when talking about doctoral programs. The practical knowledge is in a sense the beyond course experience Stewarts receive during their program. Richardson points out that it is surprising how little practical knowledge doctoral students receive during their doctoral program. She further states that practical knowledge should be "consciously" structured in the PhD program. Richardson suggested that some practical knowledge focuses on teaching, writing proposals and managing projects, writing for publications, and networking.

Socialization Theory

This section provides information about the theoretical framework, socialization theory. First, background information about of socialization will be presented. Next, socialization theory will be presented in terms of students entering graduate programs. Finally, information about the socialization of faculty will be presented.

Background

Early socialization theory can be found in the works of Plato, Montaigne, and Rousseau; however, it was not until the 1890s that the term socialization was being used

by American sociologist (Clausen, 1968). Socialization involves the transmission of information and values, thus it is a cultural matter (Van Maane & Stein, 1979). Thus, Clausen (1968) defined socialization as the process of learning one's culture and how to live within it. Socialization is the development of individuals in which they learn to develop the values, attitudes, skills, and knowledge needed for membership in an organization (Merton, 1957; Inkles, 1969; Van Maane & Stein, 1979; Tierney, 1997) In order for someone to be socialized, cognitive learning must take place and the individual must internalize appropriate norms (Moore, 1969, Tierney & Rhodes, 1993; Weidman, Twale, & Stein, 2001). Chinoy (1961) says that socialization serves two important functions. First, socialization prepares the individual for

> the roles he is to play, providing him with the necessary repertoire of habits, beliefs, and values, the appropriate patterns of emotional response and the modes of perception, the requisite skills and knowledge (p. 75).

Second, socialization allows society to pass down culture from one generation to the other to allow for continuity.

Socialization is an ongoing process and occurs most clearly when new recruits enter a new occupation. The branch of socialization theory that studies occupations is called organizational socialization. Van Maanen and Stein (1979) state that organizational socialization is the process by which people "learn the ropes" of a particular organizational role (p. 211). Furthermore, Van Maanen and Stein state that individuals may learn their new role by a quick trial and error method or a long process of education and apprenticeship may be needed.

Moore (1969) states that an occupation is a social construct composed of social actions and norms. Occupations involve both general norms and rules of conduct applicable to district occupations. In order for a new recruit to be successful, Moore contends that occupational norms must be learned. When an individual enters an organization socialization takes place when the organization transforms the individual (Wanous, 1980).

Wanous (1980) stated that in order for individuals to be successful in an organization, there must be three components. First, the individual must have knowledge of what is expected of him or her. Second, the individual must have the skills and ability to do the job. Finally, the individual must be motivated to do at least the minimum of what is expected of them.

New recruits are socialized in stages. Stages may be based on the passage of time or occurrence of certain events; however, the passage of time may not be enough for an individual to pass to the next stage (Wanous, 1980). Wanous states that organizations must establish a clearly defined sequence among stages and guidelines be put in place to know if new recruits have past through a stage. Feldman (1976) states there are three stages that new recruits go through when entering an organization. Stage one is the anticipatory socialization. This occurs when an individual decides to enter an organization. Feldman says that the expectations of the individual and organization must be realistic and the individual must be well matched with the organization. Once an individual enters an organization they go through the second stage, accommodation. This stage includes the individual being initiated to their job and their role in the organization. The third stage is role management. Here the individual makes the decision to stay in the

organization based on how well the job fits into their life and how well the individual is able to deal with conflict as their job.

Doctoral Students

Socialization in graduate school refers to the process through which individuals gain the knowledge, skills, and values necessary for successful entry into a professional career (Weidman, Twale, & Stein, 2001). When students enter a graduate program they are in the anticipatory stage. Weidman, Twale, and Stein state that students become aware of the "behavior, attitudinal, and cognitive expectations held for a role incumbent" (p. 12). For those wanting to become faculty members, graduate training serves as a significant force in socializing students into the roles and expectations associated with faculty life (Tierney & Rhoads, 1993). During graduate training, students anticipate the types of roles and behaviors they must enact to succeed as faculty members. In order for graduate students to be socialized there are three core elements that occur. First, there is knowledge acquisition. Students acquire the necessary cognitive and affective knowledge needed for their field. The student also develops a professional identity. The next core is investment. Here students show their commitment through time. Through investment, students become comfortable with themselves and their new role. The final core is involvement. Here students participate in some aspect of a professional role through collaboration with faculty and peers. So doctoral students work with professors to observe and internalize the norms of behavior for things such as research (Tierney & Rhodes, 1993).

Weidman, Twale, and Stein state that "the socialization of graduate students should be thought of a process of mutual exchange rather than as something done to students by faculty" (p. 96). Thus, the relationship between faculty and student should be interactive, collaborative, and open. Weidman, Twale, and Stein state that through the close interaction with faculty, students may start to resemble their mentors; however, students have "the power and potential to modify the standard socialization process as they evaluate their progression through their program" (p. 19). Peers also play an important role in socializing doctoral students. Peers can become "assignment clarifiers, reality checkers, surrogate families, sounding boards, and progress monitors" (p. 82).

Weidman, Twale, and Stein state that sociologist have developed several models to show the process that graduate students go through during their graduate program. The most basic model is displayed in Figure 2.1. Another model is given by Figure 2.2, which shows a nonlinear model. Weidman, Twale, and Stein indicate this model is better since it allows for reflection especially from the graduate program.

Faculty

Faculty go through an anticipatory socialization mainly during their graduate school experience. When students graduate and become new faculty members their initial socialization may or may not match the culture of their new organization (Tierney & Rhodes, 1993). This is especially true when a faculty member with a research orientation enters an institution where teaching takes precedence, or when one that has a teaching orientation enters an institution where research takes precedence. Thus, faculty must go through a transformation process (Tierney & Rhodes, 1993).

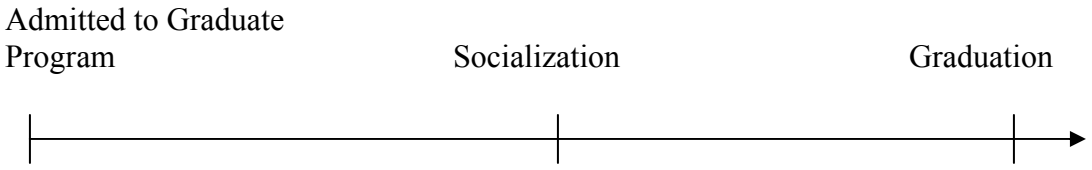

Figure 2.1. Linear model of students progressing through graduate programs.

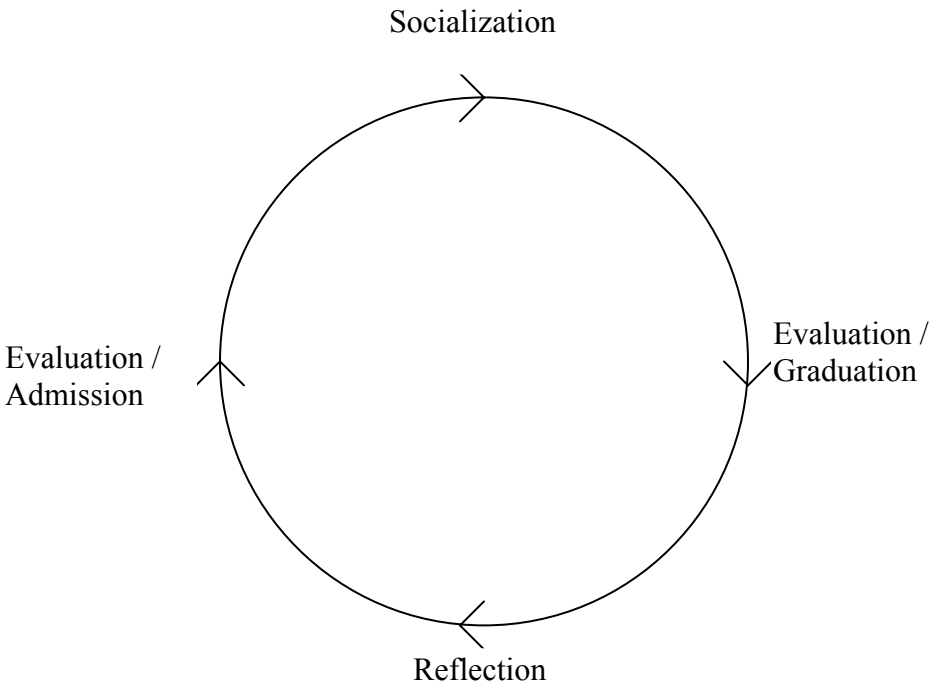

Figure 2.2. Model showing the socialization process of an internal university community.

Faculty socialization occurs when faculty becomes accustomed to the new organization's norms. Thus, the faculty goes through an organizational stage. This occurs when a faculty member enters the institution for the first time and comes into contact with the institutional culture (Tierney & Rhodes, 1993). Tierney and Rhodes states there are two phases to organizational socialization: initial entry and role continuance. Role continuance occurs after the individual is situated in the organization. At this stage individuals go through the socialization stage that will influence their decision to stay in the organization and take on the norms and values of the organization (Tierney & Rhoads, 1993).

Summary

Even during the early stages of the development of the Ph.D. in the United States, a concern about the quality and purpose of graduate education emerged. There was a constant concern about whether or not graduate education is meeting the needs of the current and future students. There have been many efforts to guide the development of doctoral programs including the AAU and the National Board on Graduate Education

The first comprehensive look of the field of mathematics education was not truly studied until 1999 with the Conference on Doctoral Programs in Mathematics Education held at the University of Missouri. The conference brought new attention to doctoral programs and students. A new area of interest, beyond course experiences, was identified. Coursework alone is not enough. It is important that doctoral programs design beyond course experiences so they complement coursework and to approximate the roles and responsibilities of mathematics educators.

The Carnegie Foundation for the Advancement of Teaching took on a project in 2001 to help coordinate reform efforts. Their project, Carnegie Initiative on the Doctorate (CID), sought to answer the question, what is the purpose of doctoral education? The CID stated the purpose was to prepare Stewarts. This stewartship can be viewed as the process of caring for and managing their field of study. Furthermore, Stewarts must know how to prepare the next generation of Stewarts.

CHAPTER III

Methods

Chapter Introduction

When conducting a research study, a researcher must select his/her approach: quantitative, qualitative, or mixed methods. According to Creswell (2003) a quantitative approach is used when testing a theory or identifying factors that influence an outcome. Qualitative is used when the research is exploratory and the variables are not known (Creswell, 2003). Finally, a mixed method approach uses both the quantitative and qualitative approach. Using both closed-ended quantitative data and open-ended qualitative data is "advantageous to best understand a research problem" (p. 22).

Creswell (2003) says there are three considerations that play into the decision of which approach to use: the research problem, the personal experience of the researcher, and the audience(s) for whom the report is written. This study focused on whether the training of current doctoral students matched with the requirements for new hires in mathematics education. The study also sought to investigate if institutional differences make a difference in the training and/or hiring of doctoral students in mathematics education.

In order to investigate this topic, a survey would allow for the collection of a large amount of data in an economical manner with rapid turnaround (Creswell, 2003). Quantitative methods would also allow measurements to test the data for any differences. Furthermore, inferences about doctoral students and hiring practices could be made by studying a sample of the population (Babbie, 1990). Surveys do have limitations since

they involve predetermined questions that could introduce bias through the wording and choices participants are given. Thus, these closed-ended questions could affect the responses that participants select and lead to misleading findings.

The purpose of this study is to investigate the training of current doctoral students with data collected from the profession to see if there is a match or disconnection between the doctoral students' training and requirements for new hires in mathematics education. In particular this study looked at the educational background and beyond course experiences of doctoral students. Beyond course experiences are non-course experiences of doctoral students in the areas of teaching, research, scholarship, and professional development. Since beyond course experiences have not been fully studied to a great extent, a qualitative approach would allow the researcher to use open-ended questions to explore this area of study. Furthermore, a qualitative approach would allow a researcher to get the perspective of the participants rather than limiting their responses to a Likert scale.

Thus, a sequential mixed methods approach was selected. The majority of data was collected through surveys. Structured interview questions conducted by e-mail were a secondary source of data for this study. The interview data was used to support the primary data. Through looking at both data sources reliability and validity were increased.

The mixed methods approach aligned with the paradigm of postpositivist knowledge. The paradigm a researcher works under provides a framework for seeing and making sense of the world (Creswell, 1998). The paradigm affects the way the researcher perceives the world around him/her and how the researcher sets up a study and analyzes

the data (Creswell, 1998). Hatch (2002) describes the ontology of postpositivist as reality exists but is never really apprehended, only approximated. According to Hatch, the methodology should include rigorously defined qualitative methods, frequency counts, and low-level statistics. This defines the research design of this study.

Research Design

This study was designed to compare the preparation of doctoral students in mathematics education with the qualifications deemed desirable in potential new hires by faculty in mathematics education. Furthermore, data was collected about perceptions of which educational and beyond course experiences are valuable for students in their doctoral program. Data were collected with respect to the following:

1. Information about the backgrounds of doctoral students such as degrees, number of graduate mathematics courses, and educational experience.

2. Information about the doctoral students' current doctoral programs as it relates to beyond course experiences.

3. The doctoral students' perception of beyond course experiences they feel are beneficial to securing a faculty position.

4. Information about faculty hiring preference when it comes to open positions at their institution.

5. Information about what faculty offers their students in terms of beyond course experiences.

The data came from a combination of mail and online surveys along with e-mail interviews. The faculty was initially mailed a packet. The packet contained a letter stating the purpose of the study along with the deadline (one month time line) of when the survey was due (see Appendix B), an informed consent form (see Appendix C), the survey instrument entitled *Potential Mathematics Education Faculty Hiring Preferences*

Survey (see Appendix D), and a self-address stamped return envelope. Later non-responders were sent an e-mail with a link to an online survey (see Appendix E). A modification of Salant's and Dillman's (1994) model of survey administration was used for this study. A three phase administration process was used: 1) a mailing of the actual survey with cover letter, informed consent form, and preaddressed return envelope with postage was sent to the mathematics education faculty; 2) a reminder email was sent to those who did not respond to the mail survey two weeks after the mailing of the surveys to the faculty members; and 3) an email with a link to an online survey was sent soon after the reminder email. Through this process a 64% return rate was achieved.

The mail surveys contained a code to track those that did not respond to the mail survey. The code consisted of a two digit number. The code was used to identify the university. This number ranged from 01 to 58. With the online survey for those that had not responded to the mail survey, the responders had to enter their two digit institutional code to gain access to the online survey. This code was supplied in their e-mail to invite them to participate.

As names and addresses of doctoral students were not readily available, the doctoral students received an invitation to participate in an online survey via an e-mail address provided by a faculty member at their institution. When possible a faculty member different from the one that was selected for the faculty survey was contacted. The e-mail contained a statement about the purpose of the study (see Appendix F), a link to the online survey titled *Doctoral Students' Qualifications and Beyond Course Experiences Survey* (see Appendix G), and a code they had to enter to start the online survey. The code was a two digit number that was the same number as their institution

to allow to tracking of responses based on institutional differences. Once the code was entered, students had to agree to the informed consent form (see Appendix H). If they did not agree, the online connection ended. After completing the survey, students could volunteer to be included in an interview proportion of the study. Twenty-four students volunteered for the interview; however, only 12 students completed the e-mail interviewed. The response rate on the return of the doctoral students' surveys could not be tracked due to the fact that an accurate number of those receiving an invitation could not be determined.

Participants

The data was collected from current full and part-time doctoral students in mathematics education during the spring of 2008. Also one faculty member in mathematics education involved in the hiring for open positions from each institution was surveyed through mail. The following will explain the selection of the faculty members and doctoral students

Faculty in Mathematics Education

The Association of Mathematics Teacher Educators' (AMTE) website (www.amte.net) was used to identify participants. There is a link on the AMTE website that lists doctoral programs along with a contact person. There were instances when the contact person was not a faculty member in mathematics education but rather a secretary or a graduate school representative. When this occurred, another person was selected for the study either by asking the contact person or searching the institution's website. There were 37 faculty members that volunteered to participate in this study.

Doctoral Students in Mathematics Education

An e-mail was sent to a faculty member in mathematics education requesting the e-mail addresses of all full-time and part-time doctoral students in mathematics education. If the institution could not provide the e-mail addressed due to confidentiality issues, a request was made to forward the e-mail survey to their students. Only two institutions that responded to this request supplied the e-mail addresses. The rest forward the request to their students, thus it was not possible to calculate a return rate. Through this process 49 doctoral students participated in the online survey portion of this study. Table 3.1 shows the number of doctoral students and faculty participating in this study based on the Carnegie classification. Notice that a majority of the students and faculty are at RU/VH institutions (research institutions with very high research activity). Information on the current status was collected on the 49 doctoral students that participated in the study. Figure 3.1 shows that a majority of students in this study were nearing completion of their doctorate. Thus, these students would have had the possibility of many beyond course experiences opportunities.

Table 3.1

Number of Participants in Research Study by Carnegie Classification

Carnegie Classification	Doctoral Student	Faculty
RU/VH	37	23
RU/H	7	9
DRU	1	3
Master's L	4	2

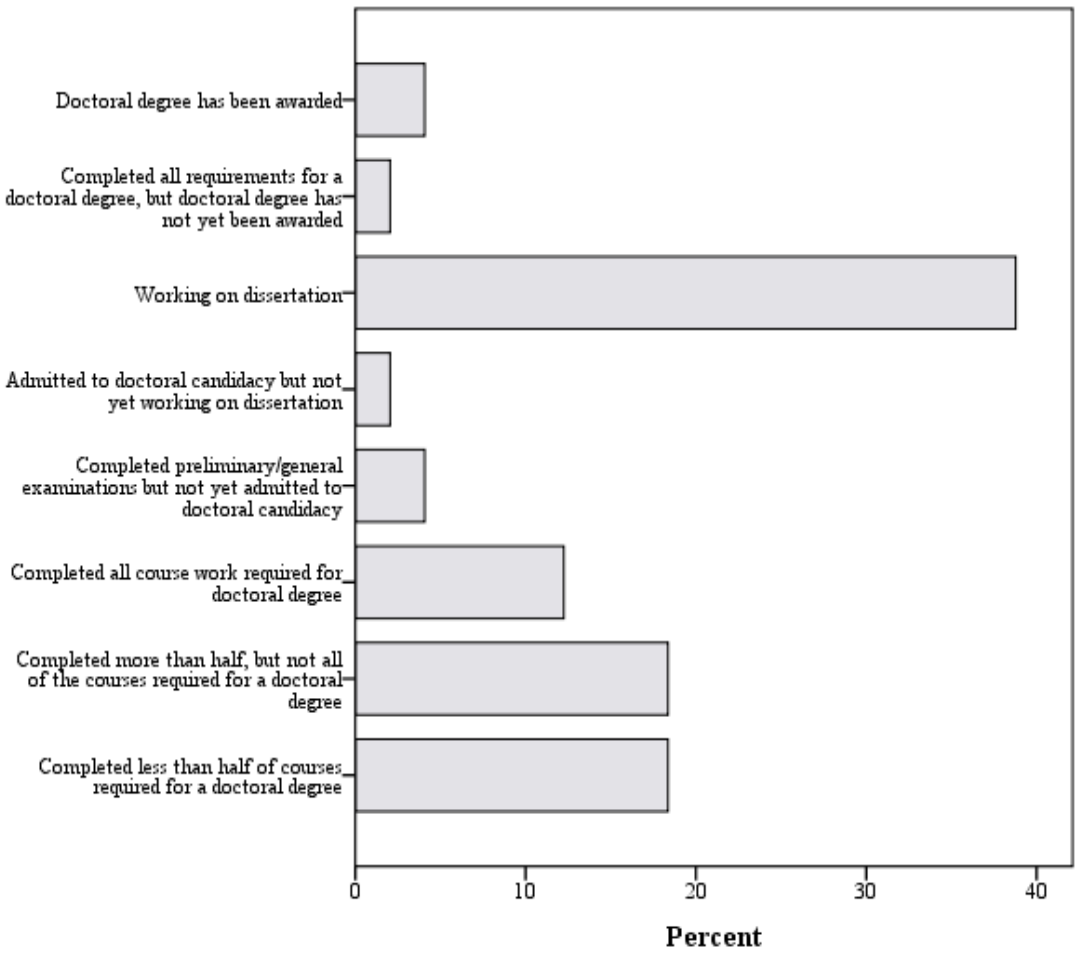

Figure 3.1. Status of doctoral students that participated in this study.

Survey Instrument

The surveys for both the students and university faculty were based on the readings from *One Field, Many Paths: U.S. Doctoral Programs in Mathematics Education* (Reys & Kilpatrick, 2001). Figure 3.2 shows how the survey questions were related to the research questions. An initial survey was developed in the fall of 2006 to survey university faculty. This online survey only resulted in 23 responses due in part to a large number of surveys being timed out. That study was not completed; thus, this new study was formed to combine faculty and doctoral students' data. The responses that were received from the 2006 study was not used but served as a test of the *Potential Mathematics Education Faculty Hiring Preferences Survey*.

Potential Mathematics Education Faculty Hiring Preferences Survey

In order to provide a broad picture of the hiring preferences of potential new hires in mathematics education and what experiences universities offer their doctoral students, a survey was designed to take around 15 minutes to complete. The survey instrument contained two main parts. One part contained questions to gather data from faculty regarding their preference when looking at new hires in mathematics education. The second part of the survey was designed to gather data from faculty regarding the beyond course experiences they value in preparing their students.

Question 1 was used for the control variable. Participants must have been a tenured or tenured track faculty member in mathematics education in order to participate. If the respondent was not a tenured or tenured track faculty member then the respondent was told to stop the survey and mail the incomplete survey back to the researcher.

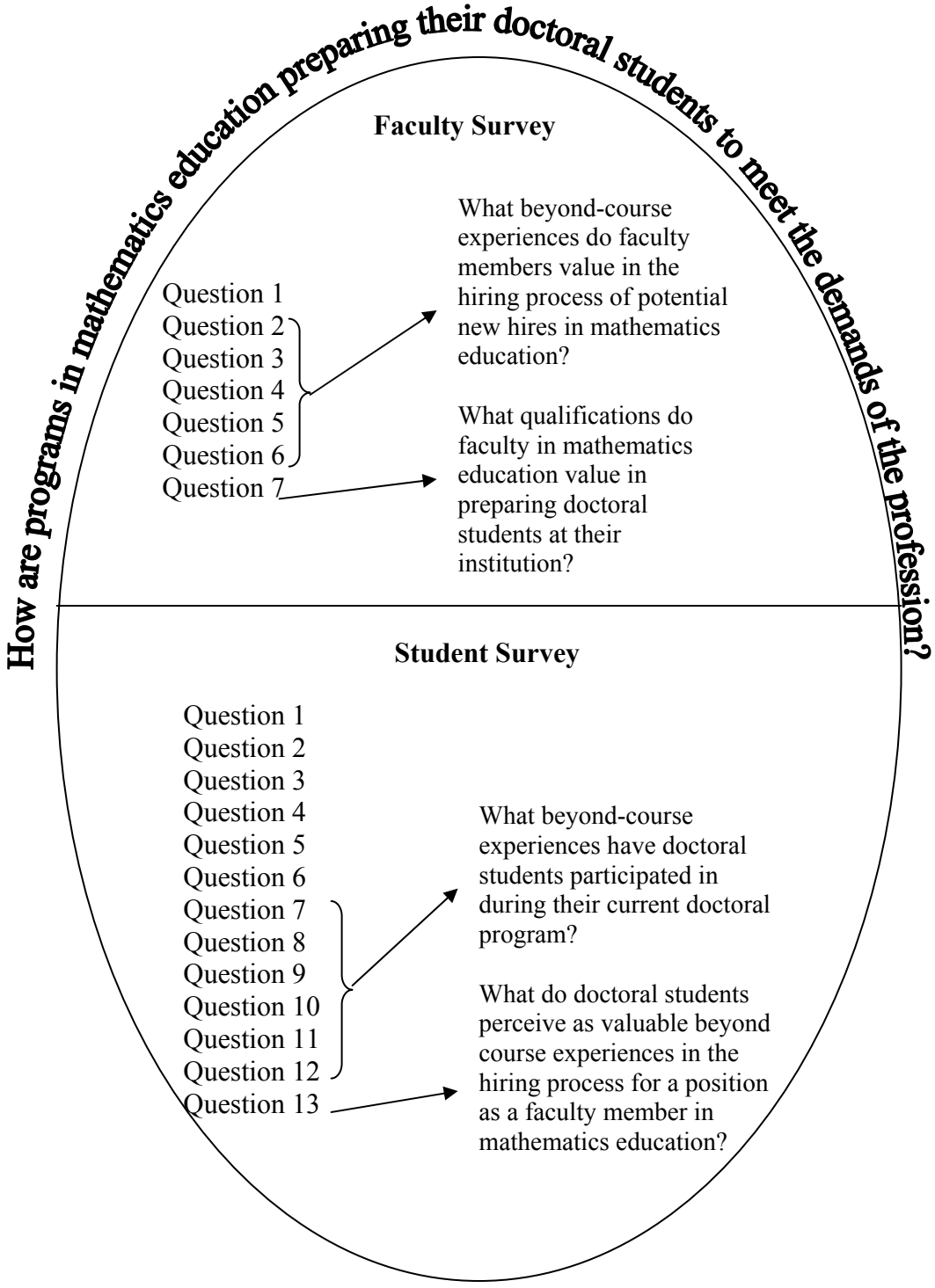

Figure 3.2. Survey questions that are linked to the research questions.

Question 2 was used to gain information about the participants' view of academic qualifications needed for open positions in mathematics education. On a Likert scale participants rated the various qualities of academic experiences (degrees, teaching, and mathematics background). Question 3 was used to gain information about the participants' view of teaching experiences needed for open positions in mathematics education. On a Likert scale, participants responded to issues about K-12 teaching experience, post-secondary teaching experiences, supervision of student/intern teachers, and whether the use of technology is important. Question 4 asked participants to offer their perspective on the scholarly work candidates must have in order to be hired for an open position in mathematics education. Topics that participants responded to included whether the candidate had done research, whether the candidate had presented at region and/or nation conferences, and whether the candidate had publications. Participants responded using a Likert scale.

Question 5 asked participants to offer their perspective on the service experiences candidates must have in order to be hired for an open position in mathematics education. Topics that participants responded to include whether the candidate has to be a member in a professional organization(s), whether the candidate has participated in institution committees, whether the candidate has been involved in curriculum development, whether the candidate has been involved in professional development, and whether the participants have worked with professional development schools. Participants responded using a Likert scale.

Question 6 was a write-in section that allowed participants to list other qualifications not listed on the survey. This data was used to provide the researcher

broader qualifications that may influence whether a candidate is hired for an open position. Question 7 asked participants to reflect on the doctoral program in mathematics education offered at their institution. Qualifications needed to enter their doctoral program along with beyond course experiences available to doctoral students were topics participants responded to using a Likert scale.

Doctoral Students' Qualifications and Beyond Course Experiences Survey

In order to provide a broad picture of the educational and beyond course experiences of current doctoral students in mathematics education, a survey was designed to take around 15 minutes to complete. The survey instrument was designed to gather data from doctoral students regarding their educational background, scholarly activities, and their perceptions of beyond course experiences that would help them secure a faculty position in mathematics education. The doctoral student survey instrument was designed analogous to the *Potential Mathematics Education Faculty Preferences* survey in order for comparisons to be made.

Questions 1 of the doctoral students' survey asked for information about teaching experiences. This information was used to compare the university data about whether teaching experience is needed for new hires in mathematics education. Of particular interest was the K-12 teaching experience.

Question 2 asked for doctoral students to respond to their educational background, especially in mathematics. Of interest is whether they have a Master's degree in mathematics or at least 18 hours of graduate credit in mathematics. The 18 hours of graduate credit in mathematics was selected since it is the minimum to be hired at

community colleges. The specific courses (Advanced Calculus, Abstract Algebra, and Non-Euclidian Geometry) were listed since Reys (2006) identified these courses as being most often needed from his survey of open positions in mathematics education.

Questions 3, 4, 5, and 6 were asked to get basic information about doctoral students such as their degree (Ed.D. and Ph.D.), enrollment status (part-time or full-time), and the number of academic years the doctoral students have been in their current program. Question 7 focused more on education experiences such as teaching courses and supervising student/intern teachers.

Question 8 focused more on scholarly activities such as conducting research, presenting at conferences, and belong to professional organizations. Question 9 allowed the participants to report on their experience with research methods (quantitative, qualitative, mixed methods, or none). Question 10 allowed the participants to type in the number of publications that had. If they did have publications they answered question 11, by supplying the types of publications they had. Question 12 allowed the participants the select the number of times they did beyond course activities. Their choices were zero, one, two, three, four, or five and more. Question 13 asked their view of beyond course experiences as it relates to obtaining a future assistant professor position.

Interview Protocol

In order to have corroborating evidence for the data collected on the survey, interview data was a second data source for this study. The primary data source for the study was the survey data with the interview data used during the interpretation part of the study (Creswell, 2003). The interview was done by e-mail in which the follow-up

participants were e-mailed a series of open ended questions. To respond, the interview participants replied with typed responses. See Appendix I for the interview protocol.

Analysis of Data

The analysis of the data was performed using SPSS (v. 16). Frequency counts and descriptive statistics were used to provide a clear picture of the experiences doctoral students were being exposed to in their doctoral program and the faculty's expectations of experiences new hires should be exposed to before applying. In order to compare the two groups to see if differences occurred, a combination of descriptive statistics and inferential statistics were used. Ranked means of the faculty's expectations of new hires were computed. Frequencies and percentages were computed with the data from the doctoral students' experiences to see if they were getting the beyond course experiences faculty expected. Inferential statistics was used to determine if differences occurred between the data about what faculty values and what doctoral saw as valuable. For this study the researcher used a MANOVA (multivariate analysis of variance) test to see if any differences occurred. Since there were statistically significant differences, independent t-tests were ran to determine where the differences occurred. An alpha of less than 0.05 was used throughout the study to determine the level of significance. All data were reviewed with a statistical consultant to reduce error in the analysis of the data.

Summary

This study was designed to provide a description of the job qualifications faculty in mathematics education feels are important when hiring junior faculty and to provide a description of the training students receive during their doctoral program. As part of the

description, information was obtained about the doctoral students' perception of what beyond course experiences are the most valuable to their future success as a faculty member. Information was also obtained on the facutly's perception of what they value in their program. This study tried to see if there is a match or mismatch between the qualifications faculty in mathematics education expects of new hires and the training doctoral students receive in their program.

CHAPTER IV

Results

Chapter Introduction

The purpose of this sequential mixed-methods study was to compare data received about the training of current doctoral students with data collected from the profession to see if there is a match or disconnect between the two groups (i.e. doctoral student's training and requirements for new hires in mathematics education). This chapter presents the descriptive and inferential analysis to answer the over arching research question: *How are programs in mathematics education preparing their doctoral students to meet the demands of the profession?* To answer this question, sub-questions were investigated for doctoral students and faculty. For faculty, the sub-questions were: 1) *What educational and beyond-course experiences do faculty members value in the hiring process of potential new hires in mathematics education?*; and 2) *What qualifications do faculty in mathematics education value in preparing doctoral students at their institution?* For doctoral students, the sub-questions were: 1) *What educational and beyond-course experiences have doctoral students participated in during their current doctoral program?*; and 2) *What do doctoral students perceive as valuable educational and beyond course experiences in the hiring process for a position as a faculty member in mathematics education?*

These sub-questions fall under four major categories: Education, Teaching, Scholarly Work, and Service. Thus, the results will be presented in these four major categories. Since there were two research questions for each group, the four major

categories were divided into two sub-categories: Actual Beyond Course Experiences and Valued Beyond Course Experiences.

To present the results of the Actual Beyond Course Experiences, the researcher divided the actual experiences into two more sub-categories: Faculty and Doctoral Students. Descriptive statistics were used to analyze the Actual Beyond Course Experiences data from the faculty and doctoral students. Inferential statistics could not be used to determine if differences existed between the actual beyond course experiences faculty look for in potential new hires and the actual experience of doctoral students since the data were measured differently for these two groups. For the faculty they were responding to a 5 point Likert scale; whereas, doctoral students were responding to dichotomous questions ("yes" they had the experience or "no" they did not have the experience). Thus, for the presentation of the Actual Beyond Course Experience data, the faculty data were presented in means and standard deviation based on a five point Likert scale, and the doctoral students' data were represented in percentages based on frequency counts.

For the Valued Beyond Course Experiences data, inferential statistics were used since both groups reported their value of beyond course experiences using Likert scales. Since the doctoral students responded on a 4 point scale, the faculty scale was collapsed to match up with a 4 point scale. To collapse the scales, the data under "not required" and "marginally important" were grouped together. Also the data under "highly important" and "required" were grouped together.

The inferential statistics used was a MANOVA test which was run using SPSS to determine if differences between the two groups occurred. Results of the test revealed

there were significant differences between the two groups. See Table 4.1 for the SPSS output. The MANOVA test only revealed that differences occur. The test does not reveal where those differences were so independent sample t-tests were ran in SPSS. The results of the independent sample t-tests will be presented under each of the four categories (Education, Teaching, Scholarly Work, and Service) below. Alpha was used at the 0.05 level, thus anything below this value meant there was a significant difference.

Table 4.1

SPSS Output of MANOVA Test

Multivariate Tests[b]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.991	3.823E2	18.000	59.000	.000
	Wilks' Lambda	.009	3.823E2	18.000	59.000	.000
	Hotelling's Trace	116.631	3.823E2	18.000	59.000	.000
	Roy's Largest Root	116.631	3.823E2	18.000	59.000	.000
group	Pillai's Trace	.634	5.688[a]	18.000	59.000	.000
	Wilks' Lambda	.366	5.688[a]	18.000	59.000	.000
	Hotelling's Trace	1.735	5.688[a]	18.000	59.000	.000
	Roy's Largest Root	1.735	5.688[a]	18.000	59.000	.000

a. Exact statistic

b. Design: Intercept + group

Education

The first main category of analysis was Education. This category was broke down into the two sub-categories of Actual Beyond Course Experiences and Valued Beyond Course Experiences. For the faculty members, the survey questions were about what qualities and qualifications they looked for in potential new hires in mathematics education at their institution. Topics covered included the importance of the levels of degrees in mathematics, whether a job candidate had an Ed.D or Ph.D, the importance of a candidate's program of study, the importance of the candidate's K-12 teaching experience, and the importance of where the candidate obtained his/her degree. For the doctoral students, the questions on the survey were about their past mathematics courses, their levels of degrees in mathematics, and whether or not they were working on an Ed.D. or a Ph.D.

For the presentation of the Actual Beyond Course Experiences data, the faculty data are presented in means and standard deviation based on a five point Likert scale, and the doctoral students' data are represented in percentages based on frequency counts. The presentation of the Valued Beyond Course Experiences data is presented using inferential statistics based on the MANOVA test. Since differences were detected, independent sample t-tests were ran to see where those differences occurred.

Actual Beyond Course Experiences

Faculty. The faculty (n = 37) responded to questions on part of their survey about experiences they look for in potential new hires in mathematics education in terms of the category education. Each question used a 5 point Likert scale (Not Important, Marginally

Important, Important, Highly Important, and Required). To analyze this data descriptive statistics were used. In particular the means and standard deviations were computed. Table 4.2 presents the results. Notice ranked means were displayed to show how faculty rated the importance of the questions about educational experiences.

The results from the survey indicated that faculty highly valued a doctorate degree in mathematics education or equivalent as oppose to a doctoral degree in mathematics. The survey revealed experiences faculty felt were important for a candidate to have when applying for a position. Those experineces included the candidate having an undergraduate degree in mathematics; the candidate's program of study; the candidate's univerisity/college that granted their doctoral degree; the candidate possesing K-12 teaching licensure; and the candidate having a Master's degree in mathematics education or mathematics.

Table 4.2
Educational Experiences of Doctoral Students Desired by Faculty

	N	Mean[α]	Std. Deviation
Doctorate degree in mathematics education or equivalent	37	4.86	.419
Undergraduate degree in mathematics or equivalent	37	3.86	.822
Program of study (e.g. transcript)	37	3.76	1.011
University/college from which Ph.D. or Ed.D. is granted	37	3.51	.507
K-12 teaching licensure	37	3.30	1.102
Masters degree in mathematics education or equivalent	37	3.14	.948
Masters degree in mathematics or equivalent	37	3.03	1.067
Candidate holds a Ph.D. rather than an Ed.D.	37	2.49	1.325
Doctorate degree in mathematics or equivalent	37	1.65	1.111

[α] 5 = Required, 4 = Highly important, 3=Important, 2=Marginally Important, 1=Not Important

Doctoral Students. Doctoral students reported that 81.6% of them had an undergraduate degree in mathematics with 44.9% stating they had a Master's degree in mathematics. Since 81.6% of the doctoral students had an undergraduate degree in mathematics, this appears to match up with the faculty expectations (mean = 3.89) that this is an important education for job candidates to have. Sixty five percent reported having at least 18 hours of graduate mathematics. Students also responded to the degree they are working on with 91.8% stated they were completing a Ph.D. in mathematics education. Even though 91.8% of the doctoral students were working on a Ph.D. rather than an Ed.D., this is only marginally important to whether a candidate gets hired according to the faculty (mean=2.49).

There were no questions on the doctoral students' survey about the importance of their institution to get a position as an assistant professor. However, having noticed the faculty responses the researcher asked the doctoral students about the importance of the institution that grants their degree during the interview. A majority of the doctoral students' responses agreed with the faculty. However, some did indicate that there needs to me more than just the institution. For example a respondent stated that, "A PhD. from Harvard is going to look amazing to a search committee, but your research and interview have to show that you are truly an excellent mathematics educator" (Interview Transcript, May 2008).

Valued Beyond Course Experiences

Table 4.3 displays the group statistics and Table 4.4 displays the SPSS results of the t-test. There were no significant differences in the category of Education.

Table 4.3
Group Means on the Value of Education

	Doctoral Students	Faculty
Masters Degree in Mathematics Education	2.91	2.73
Masters Degree in Mathematics	2.54	2.38
Having 18 or over graduate hours in mathematics	2.98	3.03

4 = Highly important, 3=Important, 2=Marginally Important, 1=Not Important

Table 4.4
Independent Sample t-tests about Value of Education

		Test for Eq of Var		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Error Diff	95% C.I. of the Difference	
									Lower	Upper
Masters' Degree in Math Education	Equal variances assumed	1.837	.179	.775	81	.441	.183	.237	-.287	.654
	Equal variances not assumed			.764	72.295	.447	.183	.240	-.295	.662
Masters' Degree in Math	Equal variances assumed	9.357	.003	.686	81	.494	.165	.241	-.314	.644
	Equal variances not assumed			.665	65.002	.508	.165	.248	-.331	.661
Having 18 or over graduate hrs in math	Equal variances assumed	3.644	.060	-.208	82	.836	-.048	.233	-.511	.415
	Equal variances not assumed			-.202	67.528	.841	-.048	.239	-.526	.429

The faculty indicated that a Master's degree in mathematics education or equivalent and Master's degree in mathematics or equivalent were marginally important for their doctoral students. Recall that when faculty are evaluating potential candidates for an open position in mathematics education the Master's degree in mathematics education or Master's degree in mathematics were important. Thus there was an inconsistence in what faculty expects for new hires and what they value for doctoral students at their institution.

Teaching

The second main category of analysis was Teaching. This category was broke down into the two sub-categories of Actual Beyond Course Experiences and Valued Beyond Course Experiences. For the faculty members, the survey questions were about what qualities and qualifications they looked for in potential new hires in mathematics education at their institution. Topics covered included the importance of the K-12 teaching experience, post-secondary teaching experience, whether a job candidate had experience supervising interns/student teachers, and the importance of whether a candidate has used technology in their teaching. For the doctoral students, the questions on the survey were about their past teaching experiences, whether they have taught a mathematics education methods course and/or mathematics course, and whether or not they had experience supervising student teachers/interns.

For the presentation of the Actual Beyond Course Experiences data, the faculty data is presented in means and standard deviation based on a five point Likert scale, and the doctoral students' data is represented in percentages based on frequency counts. The

presentation of the Valued Beyond Course Experiences data is presented using inferential statistics based on the MANOVA test. Since differences were detected, independent sample t-tests were ran to see where those differences occurred.

Actual Beyond Course Experiences

Faculty. For the teaching category respondents answered questions using a 5 point Likert scale. Table 4.5 shows the ranked means with standard deviation. The results of the survey indicated that faculty valued K-12 Teaching, use of technology, and post-secondary teaching experience in mathematics education when evaluating a candidate for a position. The survey revealed that supervision of student/intern teachers and post-secondary teaching experiences in mathematics were only marginally important to faculty.

Doctoral Students. The 49 doctoral students reported that 69.4% had experience teaching at the secondary level, 63.3% had experience teaching at the post-secondary level, 55.1% had experience teaching at the middle school level, and 14.3% had

Table 4.5
Teaching Experiences of Doctoral Students Desired by Faculty

	N	Mean[α]	Std. Deviation
K-12 teaching experience	37	3.68	.944
Use of technology to improve mathematics instruction	37	3.35	.919
Post-secondary teaching experience in mathematics education	37	3.05	.743
Supervision of student/intern teachers	37	2.41	.798
Post-secondary teaching experience in mathematics	37	2.16	1.014

[α] 5 = Required, 4 = Highly important, 3=Important, 2=Marginally Important, 1=Not Important

experience teaching at the elementary level. Based on the percentages there appears to be a match between the K-12 teaching experiences and the expectation faculty look for in potential candidates (mean=3.68). During their doctoral experience 53.1% had experience teaching a mathematics methods course and 44.9% had experience teaching a mathematics course. Since 53.1% had experience teaching a mathematics methods course this matches the faculty saying this is an important experience (mean=3.05).

There were 44.9% of the respondents that reported having experience supervising interns/student teachers. Faculty indicated that supervising interns/student teachers was marginally important with a mean of 2.41. The fact that students were gaining the supervising experience would not harm them when applying for a position.

Valued Beyond Course Experiences

There were significant differences under the category of Teaching based on the independent sample t-tests. Table 4.6 displays the group statistics and Table 4.7 displays the SPSS results of the t-test. The value of the experiences of K-12 Teaching, supervising student/intern teachers, and teaching methods courses all had p-values less than 0.05. For these three experiences, the doctoral students appeared to value these experiences more than the faculty members based on the means. Both the doctoral students and faculty indicated K-12 Teaching was important, but the doctoral students' means were higher than the faculty.

The faculty indicated that supervising student/intern teachers and teaching methods courses were marginally important; whereas, the doctoral students indicated these two experiences were important. Recall that faculty indicated post-secondary

Table 4.6
Group Means on the Value of Teaching

	Doctoral Students	Faculty
K-12 Teaching	3.57	3.14
Supervising student/intern teachers	2.98	2.46
Teaching methods courses	3.23	2.81

4 = Highly important, 3=Important, 2=Marginally Important, 1=Not Important

Table 4.7
Independent Sample t-tests Results on the Value of Teaching

		Test for Eq of Var		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Error Diff	95% C.I. of the Difference	
									Lower	Upper
K-12 Teaching	Equal variances assumed	3.276	.074	2.326	84	.022	.436	.188	.063	.809
	Equal variances not assumed			2.248	66.329	.028	.436	.194	.049	.824
Supervising student /intern teachers	Equal variances assumed	11.408	.001	2.417	83	.018	.520	.215	.092	.947
	Equal variances not assumed			2.323	63.551	.023	.520	.224	.073	.967
Teaching methods courses	Equal variances assumed	.349	.556	2.246	83	.027	.418	.186	.048	.789
	Equal variances not assumed			2.193	69.388	.032	.418	.191	.038	.799

teaching experience in mathematic education was important when evaluating potential candidates, yet the faculty indicated teaching a methods course at their institution as marginally important. Thus there was an inconsistence in what faculty expects for new hires and what they value for doctoral students at their institution.

The interview data support why students reported teaching a methods course was a valuable experience. For example, one student reported that

> This is probably more important than the other questions you have asked. I know that some graduates from my institution have been hired specifically because of experience teaching a methods course and other have just missed the cut because they did not have the elementary or secondary methods experience the school was looking for at the time (Interview Transcript, May 2008).

Another student stated teaching a methods course was a requirement.

> I only know that my advisor and department chair have stressed this as a necessary object to meet before I graduate (Interview Transcript, May 2008).

Several students stated the important of having the experience teaching a methods course depends on the institution one is applying to and also the department.

> I think it depends upon what your role will be and if you are in the math department, education department or mathematics education department. If you will strictly be teaching mathematics courses, or if you are strictly doing research, then there isn't necessarily the expectations that you have taught a methods course. However, if you will be teaching methods

> courses, you should have experience during your PhD program (Interview Transcript, May 2008).

One student stated having the experience as important but stated it was not essential to get a position as an assistant professor in mathematics education, which is in line with the view of the faculty.

> It is important to either have teaching experience in the public school arena or methodology course. I do not believe both is necessary but beneficial (Interview Transcript, May 2008).

Scholarly Work

The third main category of analysis was Scholarly Work. This category was broke down into the two sub-categories of Actual Beyond Course Experience and Valued Beyond Course Experience. For the faculty members, the survey questions were about what qualities and qualifications they looked for in potential new hires in mathematics education at their institution. Topics covered included the importance of an active research agenda, the candidates preferred research method, the importance of participating in externally funded research projects, presentations, whether a job candidate had a history of scholarly publications, and the importance of whether a candidate has a potential for scholarly publications. For the doctoral students, the questions on the survey were about their research experiences, their research methods they have used, whether they have presented at conferences, and whether or not they have publications.

For the presentation of the Actual Beyond Course Experience data, the faculty data is presented in means and standard deviation based on a five point Likert scale, and the students' data is represented in percentages based on frequency counts. The presentation of the Valued Beyond Course Experience data is presented using inferential statistics based on the MANOVA test. Since differences were detected, independent sample t-tests were ran to see where those differences occurred.

Actual Beyond Course Experiences

Faculty. For the scholarly work category respondents answered questions using a 5 point Likert scale. Table 4.8 shows the ranked means with standard deviation. The results of the survey indicated that faculty highly valued evidence of potential for scholarly publication, active research agenda, and presentations at national, regional, state, and/or local conferences. The survey also indicated that a history of scholarly

Table 4.8
Scholarly Work of Doctoral Students Desired by Faculty

	N	Mean[α]	Std. Deviation
Evidence of potential for scholarly publications	37	4.73	.508
Active research agenda	37	4.59	.551
Presentations at national, regional, state, and/or local conferences	37	4.03	.726
History of scholarly publications	37	3.92	.722
Participation in externally funded research projects	37	3.16	.898
Candidate prefers largely mixed-methods research	37	1.86	1.110
Candidate prefers largely quantitative research methods	37	1.57	.959
Candidate prefers largely qualitative research methods	37	1.46	.836

[α] 5 = Required, 4 = Highly important, 3=Important, 2=Marginally Important, 1=Not Important

publications and participation in externally funded research projects were important to faculty. Faculty indicated that the candidate's preference for research method was not important.

Doctoral Students. For the doctoral students, a majority of students reported having an active research agenda (61.2%); however, only 38.8% were ever a principal or co-principal investigator of a research project. There were 61.2% of the respondents reporting having worked with externally funded research projects. Students also responded to questions about the research methods they have used. There were 51.0% of the respondents reporting using quantitative research methods, with 65.3% using qualitative research methods and 44.9% using mixed-methods. There were 12.2% of the respondents reporting having no experience using any of these research methods.

There were a large majority (83.7%) of students reporting having experiences presenting at conferences. This percent includes national, state, and local conferences. To focus on research and national conferences, students were asked the number of times they presented research articles at national conferences. Figure 4.1 shows the number of times doctoral students presented research papers at conferences. There were almost 60% of the doctoral students that did not have this experience. Figure 4.2 shows the number of times doctoral students presented at poster sessions. There were 40.8% that had experience presenting at poster sessions. We see that a majority of students are not presenting at poster sessions.

Having publications was low with 38.8% reporting they had that experience. Of those with publications 22.4% were in peer reviewed journals and 16.3% were in a chapter of an edited book. To determine if the 38.8% was a result of students not trying

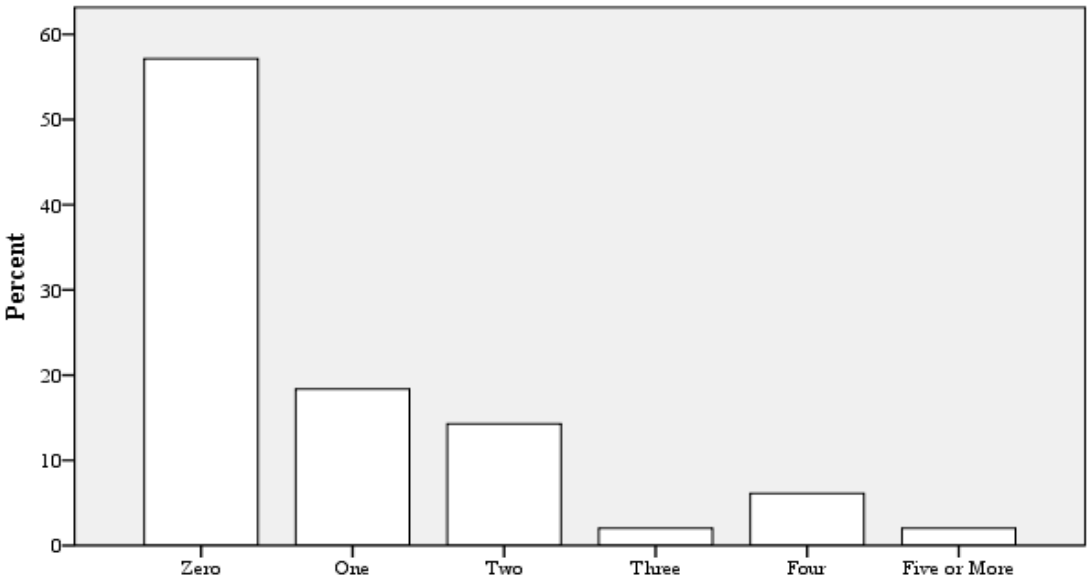

Figure 4.1. Number of times students presented a research article at a national conference.

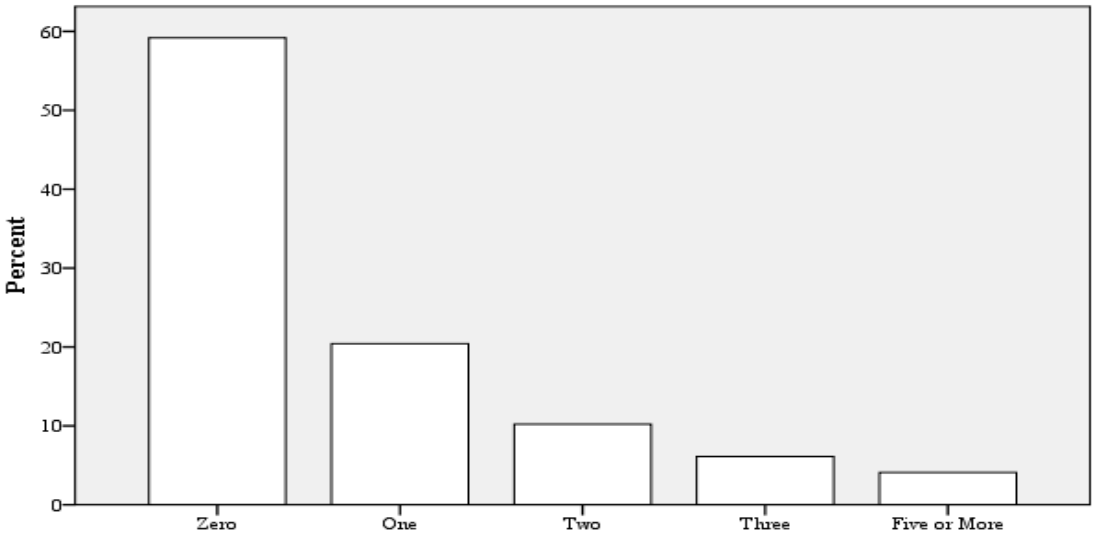

Figure 4.2. Number of times students presented at a poster session.

to publish or just not getting any of their work accepted, students were asked on the survey the number of times they submitted an article. There were 69.4% of the doctoral students reporting they have never submitted a research article for possible publication. Also 69.4% indicated they have never submitted a practitioner article for possible publication.

Figure 4.3 show the number of times doctoral students submitted research articles. Figure 4.4 shows the number of times doctoral students submitted practitioner articles. By observing both graphs, we see that a majority of students are not submitting work for publication. Thus they are not showing their potential for scholarly publications since many do not have a history of publications.

It appears there is a disconnection between the doctoral students and the faculty when it comes to scholarly work. Recall that faculty indicated that the potential for scholarly publications, active research agenda, and presentations at national, regional, state, and/or local conferences were highly important when evaluating potential candidates for an assistant professor position. Also recall that a history of scholarly publications was important to faculty when evaluating potential candidates for an assistant professor position. However, the results of the survey indicate that doctoral students are not getting these experiences during their doctoral program. There is one area which doctoral students appear to have the proper experience according to faculty-presenting at conferences.

The interview data indicated that students understand the value of having publications yet they are not taking time to submit articles. A couple doctoral students indicated that due to the shortage of faculty in mathematics education that not having

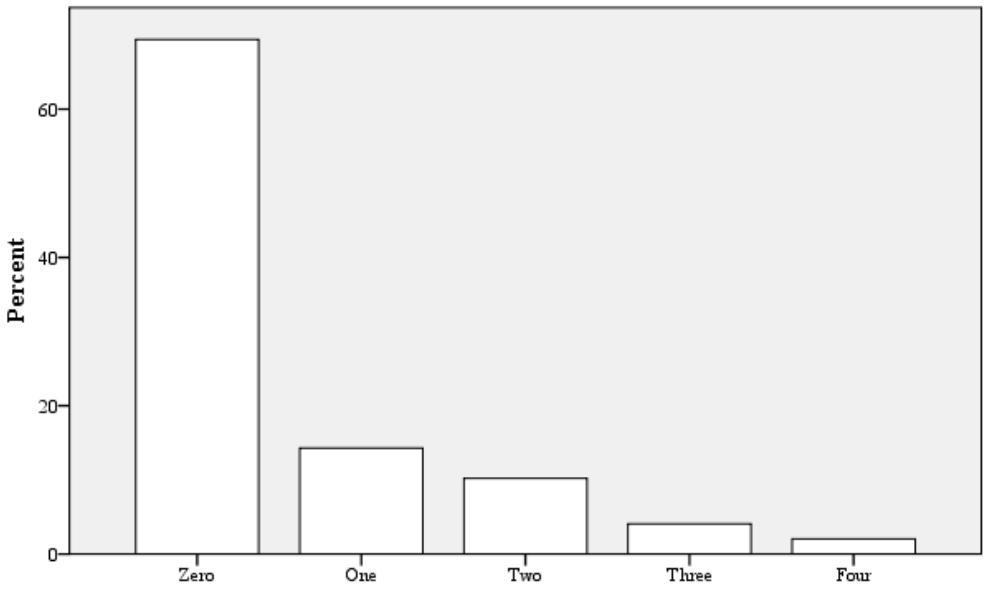

Figure 4.3. Number of times students submitted a research article.

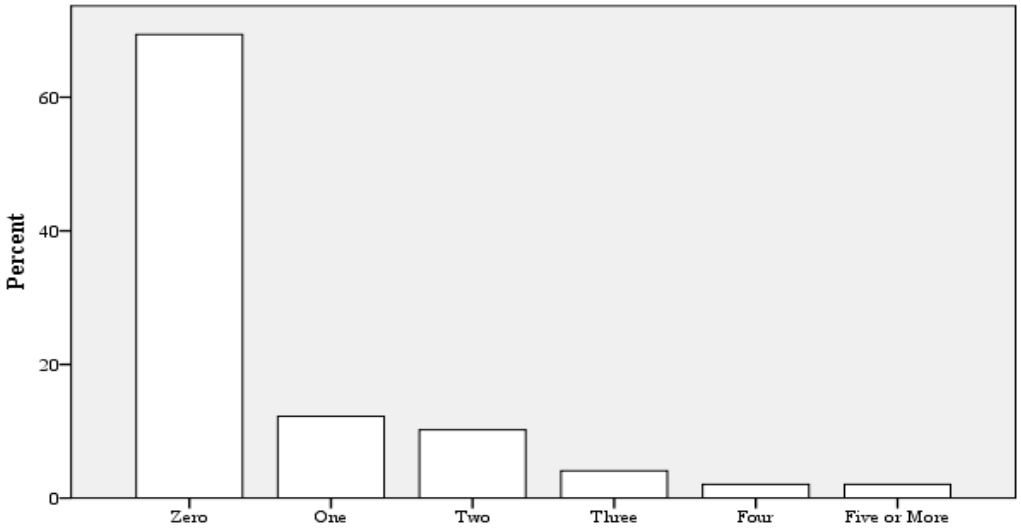

Figure 4.4. Number of times students submitted a practitioner article.

publications would not harm a candidate for an assistant professor position.

> For me, it was irrelevant. I believe this may be linked to the shortage of math education professors (Interview Transcript, May 2008).

> For math education, I believe it helps but is not critical. There are so many positions out there and so few new math ed PhDs that institutions are willing to hire even without publications. But publishing is part of the on-the-job requirement for academia (Interview Transcript, May 2008).

There was one respondent that indicated that publishing is impressive but there is not much opportunity to publish as a doctoral student.

> If we are talking about recent graduates obtaining a first position, I think publishing would be very impressive but not necessary since most don't have the opportunity to do so as Ph.D candidates (Interview Transcript, May 2008).

When respondents were asked about the important of doing presentations, many indicated that presentations indicate professional involvement to potential employers.

> If a student has taken the initiative to submit a proposal and present at a conference, it shows future employers that he/she is interested in being professionally active (Interview Transcript, May 2008).

A couple participants felt presentations were only important for bigger institutions or research institutions. One respondent that recently accepted a position stated that

> My small college employer didn't seem to care whether I had presented at conferences or not. Bigger research universities would want presentation experience (Interview Transcript, May 2008).

There were about 62% of the doctoral students that reported they had an active research agenda, which would match the faculty expectation. However, the researcher questions this number since only 38% indicated they were ever a principal or co-principal investigator for a research study. There were 57.1% that indicated they have never presented a research paper at a conference.

When respondents were asked about the importance of having research experience, nearly all respondents stated this was a key to obtaining a position at a Tier I university. Two respondents indicated that small colleges do not value research. In fact, one indicated that having research experience may be harmful when candidates apply to smaller institutions.

> For small universities, with little emphasis on research, experience doing research will not be critical. I know that in some cases, emphasizing research might even be considered negatively. The concern being that one with a great interest may not be satisfied teaching at an institution where he/she will have a heavy teaching load and little time to devote to research (Interview Transcript, May 2008).

Valued Beyond Course Experiences

There were differences under the category of Scholarly Work based on the independent sample t-tests. Table 4.9 displays the group statistic of the doctoral students

Table 4.9
Group Statistics on the Value of Scholarly Work

	Doctoral Students	Faculty
Having an active research agenda	3.30	3.84
Conducting research studies	3.29	3.84
Participating in externally funded research projects	3.00	3.35
Publishing in a peer reviewed journal	3.02	3.16
Publishing of a chapter in an edited book	2.30	2.19
Publishing of a book	2.00	1.41
Presenting at national, regional, state and/or local conferences	3.38	3.76
Presenting posters at a national, regional, state and/or local conferences	2.72	3.49

4 = Highly important, 3=Important, 2=Marginally Important, 1=Not Important

and faculty. Table 4.10 displays the SPSS results of the t-test. The value of the experiences having an active research agenda, conducting research studies, publishing a book, presenting at national, regional, state and/or local conferences, and presenting posters at a national, regional, state and/or local conferences all had p-values less than 0.05. Of these five differences, the publishing a book had a very low mean, so even though they differ they were at the not important to marginally important level. Of the other four differences, the faculty appeared to value these experiences more than the doctoral students according to the means.

Service

The fourth main category of analysis was Service. This category was broke down into the two sub-categories of Actual Beyond Course Experiences and Valued Beyond

Table 4.10
Independent Sample t-tests Results on the Value of Scholarly Work

		Test for Eq of Var		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Error Diff	95% C.I. of the Difference	
									Lower	Upper
Active research agenda	Equal variances assumed	17.856	.000	-3.881	82	.000	-.540	.139	-.817	-.263
	Equal variances not assumed			-4.114	76.527	.000	-.540	.131	-.801	-.279
Conducting research	Equal variances assumed	17.879	.000	-4.228	83	.000	-.546	.129	-.803	-.289
	Equal variances not assumed			-4.461	80.798	.000	-.546	.122	-.790	-.303
externally funded research projects	Equal variances assumed	2.471	.120	-1.941	81	.056	-.351	.181	-.712	.009
	Equal variances not assumed			-1.923	74.218	.058	-.351	.183	-.715	.013
Publishing in a peer reviewed journal	Equal variances assumed	.315	.576	-.760	83	.450	-.141	.186	-.511	.229
	Equal variances not assumed			-.750	73.354	.456	-.141	.188	-.517	.234

Table 4.10 (continued).
Independent Sample t-tests Results on the Value of Scholarly Work

		Test for Eq of Var		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Error Diff	95% C.I. of the Difference	
									Lower	Upper
Publishing of a chapter in an edited book	Equal variances assumed	7.234	.009	.555	81	.580	.115	.207	-.297	.528
	Equal variances not assumed			.536	63.018	.594	.115	.215	-.314	.545
Publishing of a book	Equal variances assumed	.098	.755	3.368	82	.001	.595	.177	.243	.946
	Equal variances not assumed			3.404	80.131	.001	.595	.175	.247	.942
Presenting at conferences	Equal variances assumed	13.350	.000	-2.726	82	.008	-.374	.137	-.647	-.101
	Equal variances not assumed			-2.842	80.943	.006	-.374	.132	-.636	-.112
Presenting posters at conferences	Equal variances assumed	.594	.443	-4.253	82	.000	-.763	.179	-1.120	-.406
	Equal variances not assumed			-4.306	80.449	.000	-.763	.177	-1.116	-.410

Course Experiences. For the faculty members, the survey questions were about what qualities and qualifications they looked for in potential new hires in mathematics education at their institution. Topics covered included the importance of having membership and participating in professional organization, whether a job candidate had experience participating in curriculum development, the importance of having experience providing professional development, and the importance of whether a candidate has experience working with professional development schools. For the doctoral students, the questions on the survey were about whether they have memberships in professional organizations, any experience providing professional development and/or curriculum development, and whether or not they had experience working with professional development schools.

For the presentation of the Actual Beyond Course Experience data, the faculty data is presented in means and standard deviation based on a five point Likert scale, and the doctoral students' data is represented in percentages based on frequency counts. The presentation of the Valued Beyond Course Experience data is presented using inferential statistics based on the MANOVA test. Since differences were detected, independent sample t-tests were ran to see where those differences occurred.

Actual Beyond Course Experiences

Faculty. For the service category respondents answered questions using a 5 point Likert scale. Table 4.11 shows the ranked means with standard deviation. The results of the survey indicated faculty valued membership in professional organization. All other experiences were only marginally important.

Table 4.11
Service Experience of Doctoral Students Desired by Faculty

	N	Mean[α]	Std. Deviation
Membership in professional organizations	37	3.51	1.017
Participation in professional organization committees	37	2.73	1.045
Experience at providing professional development	37	2.70	.661
Experience in curriculum development	37	2.30	.845
Participation in University committees or equivalent	37	2.11	.774
Experience in working with professional development schools	37	2.05	.780

[α] 5 = Required, 4 = Highly important, 3=Important, 2=Marginally Important, 1=Not Important

Doctoral Students. Nearly all students (93.9%) reported having memberships in professional organizations. Since 93.9% of the doctoral students had memberships in professional organization, this appears to match up with the faculty expectations (mean = 3.51) that this is an important experience for job candidates to have. Even though a majority of doctoral students had experience providing professional development (71.4%) and participating in curriculum development (57.1%), these were only marginally important to whether a candidate gets hired according to the faculty (mean=2.70 and mean=2.30 respectively). Finally 40.8% of the students reported having experience working with professional development schools.

Valued Beyond Course Experiences

There were differences under the category of Service based on the independent sample t-tests. Table 4.12 displays the group statistics and Table 4.13 displays the results

Table 4.12
Group Statistics on the Value of Service

	Doctoral Students	Faculty
Having membership in professional organizations	3.38	3.62
Providing professional development	3.09	2.70
Participating in curriculum development	3.00	2.41
Working with professional development schools	2.71	1.95

4 = Highly important, 3=Important, 2=Marginally Important, 1=Not Important

Table 4.13
Independent Sample t-tests on the Value of Service

		Test for Eq of Var		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Error Diff	95% C.I. of the Difference	
									Lower	Upper
Membership in professional organizations	Equal variances assumed	3.188	.078	-1.549	83	.125	-.247	.159	-.563	.070
	Equal variances not assumed			-1.572	81.111	.120	-.247	.157	-.559	.066
Providing professional development	Equal variances assumed	.575	.450	1.880	81	.064	.384	.204	-.022	.791
	Equal variances not assumed			1.863	74.174	.066	.384	.206	-.027	.795

Table 4.13 (continued)
Independent Sample t-tests on the Value of Service

		Test for Eq of Var		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff	Std. Error Diff	95% C.I. of the Difference	
									Lower	Upper
Participating in curriculum development	Equal variances assumed	2.299	.133	2.962	81	.004	.595	.201	.195	.994
	Equal variances not assumed			2.932	73.708	.004	.595	.203	.190	.999
Working with professional development schools	Equal variances assumed	.005	.945	3.511	80	.001	.765	.218	.332	1.199
	Equal variances not assumed			3.483	74.179	.001	.765	.220	.327	1.203

of the t-test. Notice there were two experiences that had p-values less than alpha (participating in curriculum development and working with professional development schools). However, notice the means for these two categories are low. Also notice the means of the doctoral students are higher than faculty except for the membership in professional organizations.

The doctoral students' means were also higher to questions under the category of Teaching. This leads the researcher to wonder if this is occurring since teaching and service are experiences they have encountered during their K-12 teaching experience and

thus may see these categories as important aspects to assistant professors of mathematics education. To back up this claim, the opposite occurred under the category of Scholarly Work since the means were higher for the faculty, which would be an area the doctoral students would not have been exposed to as a K-12 teacher.

Summary

This chapter presented the results of the data to answer the question of whether doctoral students are being properly prepared to meet the demands as an assistant professor of mathematics education. The data were grouped into four main categories: Education, Teaching, Scholarly Work, and Service. For each of these categories the actual experiences and valued experiences were reported for faculty and doctoral students.

For the most part the doctoral students were getting the actual experiences faculty look for in potential new hires. In fact, often they were getting more experiences than what faculty looked for in candidates. Publication was an experience that many of the doctoral students in this study lacked. Many also lacked experience being a principal or co-principal investigator of a research study. Reasons varied of the lack of having these experiences based on the interview data. Some reasons given for not having these experiences were lack of time; experience only needed for research institutions or large universities; and the current shortage means search committees would overlook the lack of publications.

For the valued experiences, there were differences that occurred between the faculty and doctoral students based on the MANOVA test. To determine the differences

independent sample t-tests were run in SPSS. There were no differences under the category of Education. The differences that occurred under the categories of Teaching and Service were not harmful to students being properly prepared for a position as an assistant professor. For these two categories the students were getting more experience than the faculty look for in potential new hires. Students also valued these experiences more than the faculty. Many of the students indicated they had these experiences, which only makes them better prepared once they become an assistant professor. The category of Scholarly Work had differences as well. The faculty valued the scholarly work experiences more than the doctoral students.

CHAPTER V

Discussion

Chapter Introduction

The debate about the purpose of doctoral education has persisted for years. The Carnegie Initiative on the Doctorate (CID) contents that the purpose of the doctorate is to prepare a Stewart of the discipline (Golde & Walker, 2006). Stewards are charged with continuing the vigor, quality, and integrity of the field. Doctoral programs should be designed so that the coursework and experiences prepare students to take on the role of an assistant professor once they complete the program.

There is a critical need to attract more students into doctoral programs in mathematics education. Those in the doctoral programs in mathematics education have many career options outside of academics and research shows that 20% of those seeking the doctorate in mathematics education go into other areas besides higher education (Glasgow, 2001). Thus, there has been a shortage of qualified applicants for academic positions (Reys, 2000; Glasgow, 2000; Reys & Kilpatrick, 2001; Reys, 2002). Complicating matters is the fact that 80% of faculty in mathematics education are eligible to retire in 2008 (Reys, Glasgow, Ragan, & Simms, 2001; Reys, 2006). Mathematics education needs up and coming Stewarts to continue the work of the profession. Those staying in academia must be prepared to meet the demands of higher education. Coursework, while important, will not suffice. Students must have rich beyond course experiences to better prepare them for their position.

Connection to Theoretical Framework

Socialization theory was the guiding framework for this study. According to socialization theory, doctoral programs should be developing individuals (i.e. doctoral students) so they take on the values, attitudes, skills, and knowledge needed for membership in the organization (i.e. assistant professor of mathematics education) (Merton, 1957; Tierney, 1997). This study was designed to provide a description of the job qualifications faculty in mathematics education feel are important when hiring junior faculty and to provide a description of the training students receive during their doctoral program. As part of the description, information was obtained about the doctoral students' perception of what beyond course experiences are valuable to their future success as a faculty member and compared with the faculty's perception of what they value in their program. This study tried to see if there is a match or mismatch between the qualifications faculty in mathematics education expects of new hires and the training doctoral students receive in their program. The data came from a combination of mail and online surveys along with e-mail interviews. The findings of this study suggest doctoral students were for the most part being properly socialized to take on the role of an assistant professor; however, there were some areas of weakness.

How are Programs in Mathematics Education Preparing Their Doctoral Students to Meet the Demands of the Profession?

From the findings it appears that many students are getting some of the experiences faculty value in new hires, but also many experiences that faculty do not value in candidates especially in the areas of education, teaching and service. The

doctoral students' experiences and values were higher for the categories of teaching and service than those of the faculty. Perhaps since teaching and service align with past K-12 teaching experience, they may view these categories as important aspects to assistant professors of mathematics education. The opposite occurred under the category of scholarly work as the means were higher for the faculty and would not have been a part of the resposibilities as a K-12 teacher. This could be an instance where students are not being properly socialized into the profession.

Also students were getting experiences that faculty did not tend to value in potential new hires. For example, supervising interns/student teachers (mean = 2.41) and teaching a college mathematics course (mean = 2.16) were only "marginally important" to faculty. However, 44.9% of doctoral students reported experiences in supervising interns and teaching a college mathematics course. The fact that students are getting these experiences could be viewed as beneficial to potential candidates; however, if significant amounts of time with a program were devoted to areas not critical to new hires, other areas deemed more valuable might be neglected.

The fact that supervising interns/student teachers expereince was marginally important to faculty was a surprise. Perhaps, the fact that most of the faculty participating in this study were at RU/VH institutions might indicate that faculty are focused more on research and less on teacher preparation. Post-secondary teaching experience in mathematics was marginally important to faculty (mean = 2.16); however, if the position under consideration was in a mathematics department rather than education, the data might have looked differently.

Faculty indicated that having the *potential* for scholarly publications (mean = 4.73) was a "highly important" skill for potential new hires. Just merely having publications did not appear a sufficient indication of potential, since publications were "important" instead of "highly important". The faculty were not asked to indicate what they look for when deciding whether a candidate has a potential for scholarly publications. Perhaps, faculty think publishing as a doctoral student may not be easily obtainable; however, presentations (mean = 4.03) were highly important, which would be an experience more readily obtained. The potential for scholarly publications might also be a result of the candidates' active research agenda, which was highly important (mean = 4.59). The problem is that a majority of the students did not have research experience coupled with external funding. Only 38.8% of students had experience being a principal or co-principal investigator on a grant. This finding was similar to work done by Golde and Dore (2001) in which they reported that doctoral students reported that 65% were trained on how to conduct research but only 45% of those surveyed actually conducted research.

The experience of publishing was another area lacking in the training of doctoral students. Faculty indicated that publications were "important" (mean=3.92); however, most students were not getting this experience. Only 38.8% had publication experiences. Again this is similar to the findings of Golde and Dore (2001) in which they reported that only 44% of students they surveyed felt they were properly prepared to publish original work. Thus, it appears doctoral students need guidance and training on what and how to publish. The indication appears clear that students are not being socialized in this area.

The fact that students were not getting these experiences could be seen as a negative and thus will impact a student's attempts to enter the labor market (Nettles & Millett, 2006).

Through interview data some participates indicated that publications were valuable; however, their attitude was that not having this experience would not affect them from getting hired due to the shortage. For example, one stated:

> For math education, I believe it helps but is not critical. There are so many positions out there and so few new math ed PhDs that institutions are willing to hire even without publications. But publishing is part of the on-the-job requirement for academia (Interview Transcript, May 2008).

Research shows that new hires are often unfamiliar with what it takes to get tenure process or the pressures of the job (Trower, 2001). New faculty members face stress from teaching loads, developing new courses, and serving on committees. Thus, the lack of having these experiences as doctoral students could negatively impact their success after being hired.

According to socialization theory, faculty should communicate the importance of scholarly work and doctoral students should imitate faculty in the area of scholarly work. The majority of participants were from RU/VH universities, thus, scholarly work would be an area of emphasis for faculty. Faculty indicated they valued scholarly work in their program; therefore, more collaborative work with the doctoral students may be needed to socialize students into the profession.

Interestingly, some faculty do not value experiences their own programs provide, yet they look for these experience when evaluating candidates. Teaching a methods

course was one such experience. Faculty indicated that candidates having experience teaching a methods course (mean=3.05) was an "important" experience to have. However, the faculty indicated this experience was only "marginally important" for doctoral students at their university (mean = 2.81).

Also, the faculty indicated that having a Master's degree in mathematics education (mean = 3.14) or a Master's degree in mathematics (mean = 3.03) was "important" for candidates to have when applying for a position as an assistant professor of mathematics education. However the faculty indicated that a Master's degree in mathematics education (mean=2.73) or Master's degree in mathematics (mean=2.38) were "marginally important" for doctoral students entering their doctoral programs. Some programs may provide the equivalent of a Master's prior to exiting the program. Faculty did indicate that having 18 hours of graduate mathematics (mean=3.03) was "important." Perhaps the ranking as "important" was since this is the minimum number of graduate hours in mathematics needed for a position at many community colleges.

Thus, in these instances the faculty may not be properly preparing their students for the role of an assistant professor. The issue may be that faculty do not fully understand their role as defined by socialization theory. The larger goal should be to prepare Stewarts of the profession according to CID, but perhaps faculty are more narrowly focused on their agenda than what students need.

A lack of standardization in programs may be a factor. Institutions often set up their program so that it works for them, yet they fail to see that they must prepare their students for roles at institutions that may or may not be like their institution. A one-size-fits-all model for doctoral education may be hard to achieve; however, more consistency

in programs might serve students and the profession better. Programs need to require more beyond course experiences to better socialize students to the profession. Beyond course experiences are time consuming and difficult to organize and supervise. Thus, there may be a need to incorporate them into coursework.

Before doctoral programs can be changed there needs to be a clear indication of what experiences are needed. The 1999 National Conference on Doctoral Programs in Mathematics Education considered beyond courses experiences and gave possible examples needed. For example, some beyond course experiences that participants felt important included:

- mentored teaching of courses on the teaching and learning of elementary or secondary mathematics
- mentored supervision of preservice teachers' field experiences
- mentored conceptualization, conduct, and reporting of research
- developing writing expertise through submitting articles to practitioner and research journals
- oral presentation and defense of one's scholarly work (Blume, 2001, pp. 88-89).

However, there were no definitive answers as to what the profession needed at that conference. This study will assist doctoral programs by exposing beyond course experiences faculty deemed valuable.

Replication of Study

While this study aimed for a strong research design, changes should be made to strengthen the study. First, even though the institutions listed on the AMTE website

produce most of the doctorates, a larger sample would allow for institutional differences to be studied. These differences should include more geographical regions of the United States, more institutions of various student body sizes, more institutions of different Carnegie classifications, and more private institutions. This study was originally designed to answer the question of whether institutional differences matters in the hiring and training of doctoral students; however, the sample made it statistically impossible to determine if differences occurred. This is an area that needs to be addressed in future studies.

Second, in the future a better survey distribution and design should be implemented. Originally, a mail survey was designed for this study. Later an online survey was developed. The two modes of survey delivery used in this study were problematic. The use of mail surveys did not allow for quick responses since it took nearly a month to get the responses back. There was also time involved in entering the responses from the mail surveys into SPSS. All doctoral student surveys were done online and the process was much more efficient. There also needed to be more alignment between the faculty and student surveys. The original mail survey for the faculty did not allow for participants to elect to participate in an interview. The majority of faculty returned mail surveys even when non-responders where sent an e-mail reminder with a link to the online survey. The online survey did provide an option to participate in an interview; however, of the seven faculty members that took the online survey only one selected to participate. The current research would have been richer if the voices of the faculty could have been included.

The survey also failed to account for students and faculty with an elementary or middle school mathematics education focus. There should have been options for faculty to select what they look for in potential new hires in terms of elementary and middle school positions. Also doctoral students should have had options to select their focus. Some of the faculty wrote on their mail survey that some of the questions depended on if the candidate was elementary or secondary. The researcher would assume this would impact educational experiences in particular especially in terms of undergraduate degree and the number of graduate courses in mathematics.

Implication for Future Studies

As stated earlier, this study needs to be replicated using larger sample sizes so as to make generalizations and determine what different institutional factors such as Carnegie classification, student body size, and regional location might have on faculty hiring expectations. There also needs to be studies conducted with recent hires to determine what beyond courses experiences they had during their doctoral program. Then they could be asked which beyond course experiences they felt were valuable to make them a successful assistant professor of mathematics education. Also questions about what beyond course experiences they felt were not needed. This would help in designing a powerful and efficient doctoral program.

Something that has not been studied is those that fail to obtain positions as assistant professors in mathematics education. Perhaps there is a lack of personal connection with the faculty they are interviewing or perhaps it is a lack of training. By looking at the experiences of these students, a researcher could determine if their training

and beyond course experiences were an issue in not getting hired. Finally, the big issue that needs to be studied is the lack of doctoral students in mathematics education. Research shows that there is a major issue with supply and demand. Research must be done to determine what the profession can do to attract more students to the field. If there are no students in the program, then improvements to doctoral programs will not make a difference.

Conclusion

Based on socialization theory, doctoral programs should be preparing Stewards of the profession. There were areas were students were being properly socialized into the professional; however, there were also weaknesses. Indications from this study are that students are being properly prepared in the areas of teaching and service. In fact students were getting more and different experiences than faculty valued in potential new hires. Thus, there were significant differences in these two categories. The students indicated that beyond course experiences in these two areas were more important than faculty. Perhaps, faculty did not value these experiences as much given that they were from RU/VH institutions. In the area of scholarly work, there were instances where students were not getting the proper preparation. Two areas of weakness appear to be publications and conducting research.

While it may be hard to increase the numbers of doctorates in mathematics education, the success of the field can be improved through making sure doctoral programs are properly preparing students for the demands of the profession. Reys (2000) equated doctorates in mathematics education as endangered species:

> Golden lion tamarins, Siberian tigers, and doctorates in mathematics education share some common properties. While none are extinct, each is in short supply and in high demand" (p. 1267).

Like any endangered species, their habitat must be protected to keep them alive. In order to protect their habitat, doctoral programs must be studied and improved to allow for maximum success of the inhabitants. To have success, programs must be set up to allow doctoral students to mimic the role of faculty. Through improving doctoral programs, the work experiences of new hires will be successful. Through improving their work experiences, the integrity of the field will be preserved.

REFERENCES

LIST OF REFERENCES

Babbie, E. (2001). *Survey research methods* (9th ed.). Bemont, CA: Wadsworth.

Blume, G. (2001). Beyond course experiences: The role of non-course experiences in mathematics education doctoral programs. In. R.E. Reys & J. Kilpatrick (Eds.) *One field, many paths: U.S. doctoral programs in mathematics education*. Washington, DC: American Mathematical Society/Mathematical Association of America

Borkowski, N.A. (2006). Changing our thinking about assessment at the doctoral level. In P.L. Maki & N.A. Borkowski (Eds.) *The assessment of doctoral education: Emerging criteria and new models for improvement outcomes*. Sterling, Va: Stylus Publishing, LLC.

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

Castle, S. & Arends, R. I. (2003). Faculty supply and demand. *Journal of Teacher Education, 54*(2), 112-121.

Chinoy, E. (1961). *Society: An introduction to sociology*. New York, NY: Random House.

Clausen, J.A. (1968). Socialization and society. Boston, MA: Little, Brown.

Creswell, J.W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage Publications.

Creswell, J.W. (2003). *Research design: qualitative, quantitative, and mixed methods approaches* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Donoghue, E.F. (2001). Mathematics education in the United States: Origins of the field and the development of early graduate programs. In. R.E. Reys & J. Kilpatrick (Eds.) *One field, many paths: U.S. doctoral programs in mathematics education*. Washington, DC: American Mathematical Society/Mathematical Association of America

Glasgow, R. (2000) *An investigation of recent graduates of doctoral programs in mathematics education*. Unpublished doctoral dissertation, Columbia, University of Missouri.

Golde, C. M. (2001). Findings of the survey of doctoral education and career preparation: A report to the Preparing Future Faculty program, University of Wisconsin-Madison.

Golde, C.M. & Dore, T.M. (2001). At Cross Purposes: What the experiences of doctoral students reveal about doctoral education (www.phd-survey.org). Philadelphia, PA: A report prepared for The Pew Charitable Trusts.

Golde, C.M. & Walker, G.E. (Eds.) (2006). *Envisioning the future of doctoral education: Preparing stewarts of the discipline*. San Francisco, CA: Jossey-Bass.

Hatch, J.A. (2002). Doing qualitative research in educational settings. New York, NY: State University of New York Press.

Hiebert, J., Kilpatrick, J., & Lindquist, M.M. (2001). Improving U.S. doctoral programs in mathematics education. In R.E. Reys & J. Kilpatrick (Eds.) *One field, many paths: U.S. doctoral programs in mathematics education*. Washington, DC: American Mathematical Society/Mathematical Association of America

Inkeles, A. (1969). Social structure and socialization. In D.A. Goslin (Ed.) *Handbook of socialization theory and research*. Chicago, IL: Rand McNally.

Lester, F.K., & Carpenter, T.P. (2001). The research preparation of doctoral students in mathematics education. In. R.E. Reys & J. Kilpatrick (Eds.) *One field, many paths: U.S. doctoral programs in mathematics education*. Washington, DC: American Mathematical Society/Mathematical Association of America

Lovitts, B. E. (2001). *Leaving the ivory tower*. New York, NY: Rowman & Littlefield.

Merton, R.K. (1957). *Social theory and social structure*. New York: NY: Free.

Moore, W.E. (1969). Occupational socialization. In D.A. Goslin (Ed.) *Handbook of socialization theory and research*. Chicago, IL: Rand McNally.

National Association of Graduate and Professional Students. (2001). Preliminary executive summary of the National Doctoral Program Survey. Washington, DC. (http://survey-nagps.org).

Nettles, M.T. & Millett, C.M. (2006). Three magic letters: Getting to Ph.D. Baltimore, MD: The John Hopkins University Press.

Nyquist, J. D., Austin, A. E., Sprague, J., & Wulff, D. H. (2001). The development of graduate students as teaching scholars: A four year longitudinal study, final report. Seatle, WA: University of Washington.

Ott, R.L. & Longnecker, M. (2001). *An introduction to statistical methods and data analysis (5th ed)*. Pacific Grove, CA: Duxbury.

Reys, R. E. (2000). Doctorates in mathematics education: An acute shortage. *Notices of the American Mathematical Society, 47(10)*, 1267-1270.

Reys, R. E. (2006). A report on jobs for doctorates in mathematics education in institutions of higher education. *Journal for Research in Mathematics Education, 37*(4), 262-269.

Reys, R. E. (2002). Mathematics education positions in higher education and their applicants: A many to one correspondence. *Notices of the American Mathematical Society, 49(2)*, 202-207.

Reys, R. E., Glasgow, R., Ragan, G. A., & Simms, K. W. (2001). Doctoral programs in mathematics education in the United States: A status report. In R. E. Reys & J. Kilpatrick (Eds.) *One field, many paths: U.S. doctoral programs in mathematics education* (pp. 19-40). Washington, DC: American Mathematical Society/Mathematical Association of America.

Reys, R. E., & Kilpatrick, J. (Eds.) (2001). *One field, many paths: U.S. doctoral programs in mathematics education.* Washington, DC: American Mathematical Society/Mathematical Association of America.

Richardson, V. (2006). Stewarts of a field, stewarts of an enterprise: The doctorate in education. In C. M. Golde & G. E. Walker (Eds.) *Envisioning the future of doctoral education: Preparing stewarts of the discipline* (pp. 251-267). San Francisco, CA: Jossey-Bass.

Salant, P., & Dillman, D.A. (1994). *How to conduct you own survey*. New York, NY: John Wiley & Sons.

Sorcinelli, M. D. (2001). Paradise Lost: How the academy converts enthusiastic recruits into early-career doubters. Presented at AAHE Conference on Faculty Roles and Rewards, Tampa, FL.

Sowder, J. (1989). *Setting a research agenda*. Reston, VA: National Council of Teachers of Mathematics.

Thelin, J. (2004). *A history of American higher education*. Baltimore, MD: The Johns Hopkins University Press.

Tierney, W.G., & Rhoads, R.A. (1993). *Faculty socialization as cultural process: A mirror of institutional commitment*. Washington, DC: George Washington University.

Tierney, W.G., & Rhoads, R.A. (1994). *Enhancing promotion, tenure, and beyond: Faculty socialization as a cultural process*. Washington, DC: George Washington University.

Tierney, W.G. (1997) Organization socialization in higher education. *Journal of Higher Education, 68*, 1-16.

Trower, C. A. (2001). Paradise Lost: How the academy converts enthusiastic recruits into early-career doubters. Presented at AAHE Conference on Faculty Roles and Rewards, Tampa, FL.

Twomby, S. B., Wolf-Wendel, L., Willimans, J., & Green, P. (2006). Searching for the next generations of teacher educators: Assessing the success of academic searchers. *Journal of Teacher Education, 57*(5), 498-511.

Van Maanen, J., & Stein, E.H. (1979). Toward a theory of organizational socialization. *Research in Organizational Behavior*, *1*, 209-264.

Walker, G.E., Golde, C.M., Jones, L., Bueschel, A.C., & Hutchings, P. (2008). *The formation of scholars: Rethinking doctoral education for the twenty-first century*. San Francisco, CA: Jossey-Bass.

Wanous, J.P. (1980). *Organizational entry: Recruitment, selection, and socialization of newcomers*. Reading, MA: Addison-Wesley Publishing Company.

Weidman, J.C., Twale, D.J., & Stein, E.L. (2001). Socialization of graduate and professional students in higher education: A perilous passage? San Francisco, CA: Jossey Bass

White, S.R., & McBeth, M.K. (2003) A history of the doctor of arts tradition in American higher education. *Education, 123(4)*, 770-776.

Wilson, V. A. (2000). Making the move: The transition from graduate student at a phd granting university to new faculty member at a small, private liberal arts college. Paper presented at annual meeting of the mid-south educational research association, Bowling Green, KY.

APPENDIX

APPENDIX A:

Table 1: List of Institutions that Report Information on the AMTE Website

Institution	Carnegie Classification	Size	Region
Arizona State University	RU/VH	49171	W
Baylor University	RU/H	13799	S
Central Michigan University	DRU	27683	M
Florida Institute of Technology	RU/H	4683	S
Florida State University	RU/VH	38431	S
George Mason University	RU/H	28874	S
George State University	RU/H	27261	S
Illinois State University	DRU	20757	M
Indiana University	RU/VH	37821	M
Kansas State University	RU/VH	23151	M
Louisiana State University	RU/VH	32241	S
Michigan State University	RU/VH	44836	M
Montclair State University	Master's L	15637	NE
Morgan State University	DRU	6891	NE
North Carolina State University	RU/VH	29957	S
Northern Illinois University	RU/H	24820	M
Ohio University	RU/H	20143	M
Oklahoma State University	RU/H	23819	M
Oregon State University	RU/VH	19153	W
Portland State University	DRU	23444	W
San Diego State University/University of California at San Diego	RU/H RU/VH	32043 24663	W
Southern Illinois University-Carbondale	RU/H	21589	M
Stanford University	RU/VH	18836	W
Syracuse University	RU/H	18247	NE
Teachers College Columbia University	RU/H	5036	NE
Texas A&M University	RU/VH	44435	S
Texas Tech University	RU/H	28325	S
The Ohio State University	RU/VH	50995	M
The Pennsylvania State University	RU/VH	41289	NE
The University of Montana	RU/H	13558	W
University at Buffalo, SUNY	RU/VH	27276	NE
University of California, Berkeley	RU/VH	32803	W

Table 1: Continued

University of California, Santa Cruz	RU/VH	15036	W
University of Central Florida	RU/H	42465	S
University of Delaware	RU/VH	21238	NE
University of Florida	RU/VH	47993	S
University of Georgia	RU/VH	33405	S
University of Houston	RU/H	35180	S
University of Illinois at Urbana-Champaign	RU/VH	40687	M
University of Kansas	RU/VH	26980	M
University of Kentucky	RU/VH	25686	S
University of Louisville	RU/H	20729	S
University of Maryland	RU/VH	34933	NE
University of Michigan	RU/VH	39533	M
University of Minnesota	RU/VH	50954	M
University of Missouri-Columbia	RU/VH	27003	M
University of Nevada Las Vegas	RU/H	27339	W
University of New Hampshire	RU/H	14370	NE
University of New Mexico	RU/VH	26242	W
University of North Carolina Charlotte	DRU	19846	S
University of Northern Colorado	DRU	13156	W
University of South Florida	RU/VH	42238	S
University of Tennessee Knoxville	RU/VH	27792	S
University of Texas Austin	RU/VH	50377	S
University of the Incarnate Word	Master's L	4698	S
University of Wisconsin	RU/VH	40455	M
Virginia Technology	RU/VH	27619	S
Western Michigan University	RU/H	27829	M

(source: www.amte.net)

Appendix B: Cover Letter for Faculty

Dear Mathematics Education Faculty Member,

In a recent article, Reys (2006) provided information on the current state of open higher education positions in mathematics education. One finding of his study was the apparent disparity between the applicants' qualifications and job responsibilities. Reys suggests that job announcements be carefully worded to include exact qualifications and responsibilities. Based on Reys' study, an investigation of the preferences of institutions of higher education when evaluating potential candidates in mathematics education when it comes to newly graduated doctoral students in mathematics education is being conducted as part of my dissertation.

To evaluate the hiring preference of institutions for open positions in mathematics education, a survey aimed at tenured and tenure track faculty involved in the hiring process has been developed. The survey will ask questions about the qualifications you are looking for when recent graduates of doctoral degrees in mathematics education as applying for positions. You will also answer questions about training the doctoral students at your institution receive through your program. From this survey I hope to find common ground on what qualifications are preferred in order to provide institutions with guidance in refining doctoral programs. One mathematics education faculty member from each institution who has participated in the hiring process of tenure track mathematics education faculty is invited to participate in this study. If you are not a mathematics education faculty member involved in the hiring of potential new candidates in mathematics education, please forward this information to a mathematics education faculty member that can answer these questions.

Inside this envelope you will find an informed consent form, a copy of the survey, and a stamped envelope. Please read the informed consent and if you agree to participate in this important study initial the first page and sign and date the second page of the informed consent form. Please return the completed survey in the stamped envelope by _____. Thank you for you time and effort. If you have any questions, please contact me at rcolli10@utk.edu.

Sincerely,

Randy L Collins
Doctoral Student
The University of Tennessee

APPENDIX C: Faculty Informed Consent

INFORMED CONSENT FORM

Potential Mathematics Education Faculty Hiring Preferences Survey

INTRODUCTION

You are invited to participate in a research study. The purpose of the study is to investigate mathematics education departments' preferences when evaluating candidates who recently obtain a doctorate degree in mathematics education for an open position in mathematics education.

INFORMATION ABOUT PARTICIPANTS' INVOLVEMENT IN THE STUDY

By participation you will complete a 15 minute mail in survey regarding your hiring preference of potential candidates for an open position in mathematics education. Also you will be asked about your doctoral program and the qualifications your doctoral students receive.

Your responses to the survey will be collected and utilized for the purposes of this research study and may be used for future research studies, publication, and presentations.

BENEFITS

By participating in this research study, you will be contributing to the body of knowledge regarding qualifications of candidates for open positions in mathematics education who have recently received a doctoral degree in mathematics education.

CONFIDENTIALITY

The information in the study records will be kept confidential. Data will be stored securely and will be made available only to the person conducting the study. No reference will be made in oral or written reports which could link participants or institutions to the study.

COMPENSATION

None

Please initial that you have read page 1: _____

CONTACT INFORMATION

If you have questions at any time about the study or the procedures, you may contact the research, Randy L Collins, at rcolli10@utk.edu. If you have questions about your rights as a participant, contact the Compliance Section of the Office of Research at (865) 974-3466.

PARTICIPATION

Your participation in this study is voluntary; you may decline to participate without penalty. If you withdraw from the study before stat collection is completed your data will be destroyed.

CONSENT

By signing and dating this consent form, I acknowledge that I have read the above information and agree to participate in this study.

_____ _____

(Signature) (Date)

APPENDIX D: **Potential Mathematics Education Faculty Hiring Preferences Survey**

Potential Mathematics Education Faculty Hiring Preferences Survey

Conducted By

Randy L. Collins
Doctoral Student
The University of Tennessee

Thank you for participating in this research study on hiring preferences of candidates for an open position in mathematics education. You are one of a sample of faculty that has been selected from forty six universities from the AMTE website who were chosen to participate in this study.

This survey, *Potential Mathematics Education Faculty Hiring Preferences Survey*, asks you to respond to questions about what qualifications you look for when hiring potential candidates, fresh from doctoral programs, for an open position in mathematics education. You will also answer questions about the beyond course experiences your program offers doctoral students. Beyond course experiences are non-course experiences, which involve teaching, research, scholarship, and professional development. It is estimated that it will take you 15 minutes to complete this survey. Your responses will be combined with other faculty in mathematics education and will be reported as group averages. Your individual responses will be kept confidential, identified only by number, and never connected with your name in any report. No faculty will be individually identified in any of the analyses or reports.

Instructions for Completing the Potential Mathematics Education Faculty Hiring Preference Survey

Please answer as honestly and completely as possible. Your frame of reference when responding to many of these questions is as if you are thinking of potential new hires fresh from doctoral programs. ***Please place an X in the appropriate box for each question unless instructed to do other wise***

Mailing instructions for returning the completed survey: Please return the survey in the postage-paid envelope provided to:

Randy L Collins
3025 Conner Drive
Knoxville, TN 37918

1. Are you a tenured and tenure track faculty in mathematics education that is involved in hiring potential new candidates in mathematics education at your institution?

 Yes

 No (If no, please leave the rest of the questions blank and submit your survey).

Now you will answer questions about what qualities and/or qualifications you look for in potential new hires in mathematics education at your institution.

2. ***Education***

	Not at all important	Marginally important	Important	Highly important	Required
Undergraduate degree in mathematics or equivalent					
Master's degree in mathematics or equivalent					
Master's degree in mathematics education or equivalent					
Doctorate degree in mathematics or equivalent					
Doctorate degree in mathematics education or equivalent					
K-12 teaching licensure					
Candidate holds a Ph.D. rather than an Ed.D.					
University/college from which Ph.D. or Ed.D. is granted					
Program of study (e.g. transcript)					

3. ***Teaching***

	Not at all important	Marginally important	Important	Highly important	Required
K-12 teaching experience					
Post-secondary teaching experience in mathematics					
Post-secondary teaching experience in mathematics education					
Supervision of student/intern teachers					
Use of technology to improve mathematics instruction					

4. ***Research***

	Not at all important	Marginally important	Important	Highly important	Required
Active research agenda					
Candidate prefers largely qualitative research methods					
Candidate prefers largely quantitative research methods					
Candidate prefers largely mixed-methods research					
Participation in externally funded research projects					
Papers presented at national, regional, state, and/or local conferences					
Presentations at national, regional, state, and/or local conferences					
History of scholarly publications					
Evidence of potential for scholarly publications					

5. ***Service***

	Not at all important	Marginally important	Important	Highly important	Required
Membership in professional organizations					
Participation in professional organization committees					
Participation in University committees or equivalent					
Experience in curriculum development					
Experience at providing professional development					
Experience in working with professional development schools					

6. ***Please list additional preferences not included in the survey:***

Now please answer the following regarding your program of study at your institution.

7. **Students in the doctoral program at your institution should have the following experiences before or after leaving your program:** (Place a check mark in the box that best applies)

	Not Required	Not Important	Marginally Important	Important	Highly Important	Required
K-12 Teaching Experience						
Master's Degree in Mathematics Education						
Master's Degree in Mathematics						
18 or over graduate hours in mathematics						
Active Research Agenda						
Conducting research projects						
Participating in externally funded research projects						
Supervising student/intern teachers						
Teaching methods courses						
Having a publication in a journal						
Having a publication of a chapter in an edited book						
Having a publication of a book						
Presenting at national, regional, state and/or local conferences						
Presenting posters at a national, regional, state and/or local conferences						
Having membership in professional organizations						
Providing professional development						
Participating in curriculum development						
Working with professional development schools						

This concludes the survey. Thank you for your participation. Please place the survey in the self-addressed stamped envelope and return as soon as possible.

APPENDIX E: E-mail to Faculty Non-Responders

Potential Mathematics Education Faculty Hiring Preferences Survey

Conducted By

Randy L. Collins
Doctoral Student
The University of Tennessee

My records indicate you have not returned the Potential Mathematics Education Hiring Preferences Survey. If you have already mailed the survey, please ignore this message. If you are not a faculty involved in the hiring of candidates in mathematics education, please forward this survey to another faculty member that is involved in the hiring process.

Your participation is very important. By participating in this research study, you will be contributing to the body of knowledge regarding qualifications of candidates for assistant professor positions in mathematics education who have recently received a doctoral degree in mathematics education.

The purpose of the study is to investigate mathematics education departments' preferences when evaluating candidates for an assistant professor position in mathematics education at your institution. Data collected from this study will be compared to data collected from doctoral students in mathematics education to see if there is a match or disconnect between the two groups (the requirements for new hires in mathematics education and the training doctoral students receive). The study also seeks to investigate if regional differences affect the requirements for training and/or the hiring of doctoral students in mathematics education.

It is estimated that it will take you 15 minutes to complete this survey. Your responses will be combined with other faculty in mathematics education and will be reported as group averages. Your individual responses will be kept confidential, identified only by number, and never connected with your name in any report. No faculty will be individually identified in any of the analyses or reports.

In order to make the process easier, an online survey has been developed. In order to take the survey, please use the following link:

http://survey.utk.edu/mrIWeb/mrIWeb.dll?I.Project=POTENTIALMATHEM1

You will be asked to supply an institutional code for the online survey. Your institutional code is ___. This code is only used to track non-responders.

I thank you in advance for take time to complete this survey.

Randy L Collins
Doctoral Candidate

APPENDIX F E-mail to Students

Doctoral Students' Qualifications and Beyond Course Experiences

Conducted By

Randy L. Collins
Doctoral Student
The University of Tennessee

I would like to invite you to take part in a research study. Your participation is very important. You are one of a sample of doctoral students that have been selected from 58 universities from the Association of Mathematics Teacher Educators (AMTE) website.

By participating in this research study, you will be contributing to the body of knowledge regarding qualifications you receive in order to make you better prepared for an assistant professor position in mathematics education. Data collected from doctoral students will be compared to data collected from faculty in mathematics education to see if there is a match or mismatch between the experiences doctoral students receive and what faculty looks for when hiring for an assistant professor position.

This survey, *Doctoral Students' Qualifications and Beyond Course Experiences*, asks you to respond to questions about your beyond course experiences in your current doctoral program. Beyond course experiences are non-course experiences, which involve teaching, research, scholarship, and professional development. It is estimated that it will take you 15 minutes to complete this survey. Your responses will be combined with other doctoral students in mathematics education and will be reported as group averages. Your individual responses will be kept confidential, identified only by number, and never connected with your name in any report. No student will be individually identified in any of the analyses or reports. You will be asked to supply an e-mail address if you wish to participate in an e-mail interview. Your e-mail address will only be used for the purpose of this study and will not be given to anyone else.

In order to make the process easy, an online survey has been developed. You will be asked to supply an institutional code for the online survey. Your institutional code is ____. This code is only used to track non-responders.

In order to take the survey, please use the following link:

http://survey.utk.edu/mrIWeb/mrIWeb.dll?I.Project=DOCTORALSTUDENTS

I thank you in advance for take time to complete this survey.

Randy L Collins
Doctoral Candidate

Mathematics Education
University of Tennessee

APPENDIX G: Doctoral Students' Qualifications and Beyond Course Experiences Online Survey

What is your institutional code? _____

INFORMED CONSENT FORM

Doctoral Students' Qualifications and Beyond Course Experiences Survey

INTRODUCTION

You are invited to participate in a research study. This study will investigate the training doctoral students receive in order to prepare them for future positions in mathematics education. Data collected from this study will be compared to data collected from faculty in mathematics education to see if there is a match or disconnect between the two groups (doctoral students' training and the requirements for new hires in mathematics education). The study also seeks to investigate if regional differences affect the requirements for training and/or the hiring of doctoral students in mathematics education.

INFORMATION ABOUT PARTICIPANTS' INVOLVEMENT IN THE STUDY

By participation you will complete a 15 minute survey regarding your training you have received. You will be asked about the training you have received in terms of beyond course experiences in mathematics education. You will also be asked about your perception of the beyond course experiences you feel are important in order to obtain a position as a faculty member in mathematics education. Your responses will be combined with other doctoral students in mathematics education and will be reported as group averages. Your individual responses will be kept confidential, identified only by number, and never connected with your name in any report. No student will be individually identified in any of the analyses or reports. You will be asked to supply an e-mail address if you wish to participate in an e-mail interview. Your e-mail address will only be used for the purpose of this study and will not be given to anyone else.

Your responses to the survey will be collected and utilized for the purposes of this research study and may be used for future research studies, publication, and presentations.

BENEFITS

By participating in this research study, you will be contributing to the body of knowledge regarding qualifications of candidates for assistant professor positions in mathematics education who have recently received a doctoral degree in mathematics education.

CONFIDENTIALITY

The information in the study records will be kept confidential. Data will be stored securely and will be made available only to the person conducting the study. No reference will be made in oral or written reports which could link participants to the study.

COMPENSATION

None

CONTACT INFORMATION

If you have questions at any time about the study or the procedures, you may contact the researcher, Randy L Collins, at rcolli10@utk.edu. If you have questions about your rights as a participant, contact the Compliance Section of the Office of Research at (865) 974-3466.

PARTICIPATION

Your participation in this study is voluntary; you may decline to participate without penalty.

CONSENT

The return of the completed survey constitutes your consent to participate in the research.

I acknowledge that I have read the Informed Consent Statement and agree to participate in this study. The return of the completed survey constitutes your consent to participate in the research.

- ◊ Agree
- ◊ Disagree

Thank you for participating in this research on doctoral students. You are one of a sample of doctoral students that have been selected from 58 universities from the Association of Mathematics Teacher Educators (AMTE) website. Through working with a faculty representative from your university, you were chosen to participate.

1. What past teaching experiences have you had? (Mark all that apply)
   - ◊ Elementary mathematics (K-5)
   - ◊ Middle school mathematics (6-8)
   - ◊ Secondary mathematics (9-12)
   - ◊ Post-secondary mathematics
   - ◊ Other

2. What past courses and degree(s) have you had? (Mark all that apply.):
   - ◊ Undergraduate degree in mathematics or equivalent
   - ◊ Master's degree in mathematics
   - ◊ Completed at least 18 hours in graduate mathematics
   - ◊ Had a course in Advanced Calculus or equivalent
   - ◊ Had a course in Abstract Algebra or equivalent
   - ◊ Had a course in Non-Euclidean Geometry or equivalent

3. What is the current degree you are working on?
   - ◊ Ed.D
   - ◊ Ph.D.

4. During the current academic year you are primarily enrolled as:
   - ◊ Part-time
   - ◊ Full-time

5. How many years have you been in the doctoral program?
   - ◊ Less than 1 year
   - ◊ 1 to 3 years
   - ◊ More than 3 years

6. Which of the following best describes your current status in your doctoral program?
   - ◊ Completed less than half of courses required for a doctoral degree
   - ◊ Completed more than half, but not all of the courses required for a doctoral degree
   - ◊ Completed all course work required for doctoral degree
   - ◊ Completed preliminary/general examinations but not yet admitted to doctoral candidacy
   - ◊ Admitted to doctoral candidacy but not yet working on dissertation
   - ◊ Working on dissertation

7. Please answer the following about your experience in your current program:

   Have you taught a mathematics education course?
   - ◊ Yes
   - ◊ No

   Have you taught a mathematics course?
   - ◊ Yes
   - ◊ No

   Have you supervised student/intern teachers?
   - ◊ Yes
   - ◊ No

   Have you been involved in curriculum development?
   - ◊ Yes
   - ◊ No

   Have you been involved in professional development?
   - ◊ Yes
   - ◊ No

   Have you been involved working with professional development schools?
   - ◊ Yes
   - ◊ No

8. Please answer the following about your scholarly experience in your current program:

   Have you been a principal and/or co-principal investigator of a research study while in your current program?
   - ◊ Yes
   - ◊ No

   Do you currently have an active research agenda?
   - ◊ Yes
   - ◊ No

   Have you participated in externally funded research projects?
   - ◊ Yes
   - ◊ No

   Have you presented at national, regional, state, and/or local conferences?
   - ◊ Yes
   - ◊ No

Have you presented at a poster session?

◊ Yes

◊ No

Are you a member of a professional organization(s)?

◊ Yes

◊ No

9. What kind of research method(s) have you use? (Check all that apply):

◊ Quantitative

◊ Qualitative

◊ Mixed-methods

◊ None

10. If you have publications, how many do you have? If no publications, type in 0 (zero). __

11. If you have publications, answer the following Otherwise click NEXT:

Are any of your publications in a peer reviewed journal?

◊ Yes

◊ No

Are any of your publications a chapter in an edited book?

◊ Yes

◊ No

Are any of your publications a book?

◊ Yes

◊ No

12. Approximately how many times have you done the following activities since enrolling in your doctoral program?

	0	1	2	3	4	5+
Participated in an independent study						
Served as a teaching assistant for a class						
Taught a class						
Attended professional or scholarly meetings						
Presented at a poster session						
Presented a research paper at a national conference						

13. Now please rate the following experiences as to what you think is important in obtaining an assistant professor position in mathematics education.

	Not Important	Marginally Important	Important	Highly Important	Do Not Know
K-12 Teaching Experience					
Master's Degree in Mathematics Education					
Master's Degree in Mathematics					
18 or over graduate hours in mathematics					
Active Research Agenda					
Conducting research projects					
Participating in externally funded research projects					
Supervising student/intern teachers					
Teaching methods courses					
Having a publication in a journal					
Having a publication of a chapter in an edited book					
Having a publication of a book					
Presenting at national, regional, state and/or local conferences					
Presenting posters at a national, regional, state and/or local conferences					
Having membership in professional organizations					
Providing professional development					
Participating in curriculum development					
Working with professional development schools					

What are your future career plans?

Follow-Up E-mail Interview
Please provide your e-mail address if you would like to participate in a follow-up e-mail interview. If you do not want to participate click NEXT.

Thank you for your participation. Click NEXT to end survey.

APPENDIX H: Doctoral Informed Consent Form

INFORMED CONSENT FORM

Doctoral Students' Qualifications and Beyond Course Experiences Survey

INTRODUCTION

You are invited to participate in a research study. This study will investigate the training doctoral students receive in order to prepare them for future positions in mathematics education. Data collected from this study will be compared to data collected from faculty in mathematics education to see if there is a match or disconnect between the two groups (doctoral students' training and the requirements for new hires in mathematics education). The study also seeks to investigate if regional differences affect the requirements for training and/or the hiring of doctoral students in mathematics education.

INFORMATION ABOUT PARTICIPANTS' INVOLVEMENT IN THE STUDY

By participation you will complete a 15 minute survey regarding your training you have received. You will be asked about the training you have received in terms of beyond course experiences in mathematics education. You will also be asked about your perception of the beyond course experiences you feel are important in order to obtain a position as a faculty member in mathematics education. Your responses will be combined with other doctoral students in mathematics education and will be reported as group averages. Your individual responses will be kept confidential, identified only by number, and never connected with your name in any report. No student will be individually identified in any of the analyses or reports. You will be asked to supply an e-mail address if you wish to participate in an e-mail interview. Your e-mail address will only be used for the purpose of this study and will not be given to anyone else.

Your responses to the survey will be collected and utilized for the purposes of this research study and may be used for future research studies, publication, and presentations.

BENEFITS

By participating in this research study, you will be contributing to the body of knowledge regarding qualifications of candidates for assistant professor positions in mathematics education who have recently received a doctoral degree in mathematics education.

CONFIDENTIALITY

The information in the study records will be kept confidential. Data will be stored securely and will be made available only to the person conducting the study. No reference will be made in oral or written reports which could link participants to the study.

COMPENSATION

None

CONTACT INFORMATION

If you have questions at any time about the study or the procedures, you may contact the researcher, Randy L Collins, at rcolli10@utk.edu. If you have questions about your rights as a participant, contact the Compliance Section of the Office of Research at (865) 974-3466.

PARTICIPATION

Your participation in this study is voluntary; you may decline to participate without penalty.

CONSENT

The return of the completed survey constitutes your consent to participate in the research.

APPENDIX I: Interview Protocol

Dear Doctoral Student,

Thank you for completing the Doctoral Students' Qualification and Beyond Course Experience survey. On the survey you selected you wish to participate in the interview portion of the study. Below are 9 questions. To participate in this interview, reply to this e-mail with your typed responses below each question.

I thank you in advance for taking time to complete this e-mail interview.

Randy L Collins
Doctoral Candidate
Mathematics Education
University of Tennessee

Interview Questions:

1. How important do you think the institution you obtain your PhD influences what type of institution will hire you as an assistant professor?

2. How important is publishing in terms of number and type (research or practitioner) to acquiring an assistant professor position?

3. What are your perceptions about the importance of presenting at conferences to obtain an assistant professor position?

4. What are you perceptions about having experience teaching a methods course in order to obtain an assistant professor position?

5. How important do you think having experience doing research (either as the principal investigator or co-principle investigator) will influence the type of institution that will hire you as an assistant professor?

6. What are your perceptions about the value of being exposed to several research methods (quantitative, qualitative, and mixed methods) or being an expert in one research method in obtaining a position as an assistant professor?

7. In your opinion, what do you feel is the most valuable beyond course experience to obtain a position as an assistant professor? Why?

8. How necessary do you feel beyond course experiences are at making you an attractive candidate for an assistant professor position?

9. What are your perceptions about the quality of future assistant professors that have had a lot of beyond course experiences? (Do you feel the more beyond course experiences you have makes you a more effective/successful assistant professor?)

VITA

Randy L. Collins was born June, 20 1972 in Camden, TN. In 1995, Randy earned his B.S. degree in education with an emphasis in mathematics from the University of Tennessee-Martin. After teaching two years at a rural high school in northwest Tennessee, Randy moved to Knoxville, TN to obtain his Master's degree in mathematics. In May 2000 Randy graduated and took a position at Roane State Community College. There he taught developmental math and college algebra. The summer after Randy graduate from the University of Tennessee-Knoxville, Randy wanted to improve his teaching skills so he began taking mathematics education class under the direction of Dr. Vena Long. Coursework continued until May 2002. Randy moved to Michigan during the summer of 2002. While in Michigan, Randy taught at an urban high school in Toledo, OH for three years. Randy returned to Knoxville in August 2005 to continue his doctorate degree. While continuing his degree, Randy was first a Graduate Teaching Assistant (GTA) and later a Graduate Research Assistant (GRA). After two years of course work, Randy took a position as a middle school math teacher for the Knox County School system. During the 2008-2009 academic year, Randy accepted a position at Roane State Community College. On September 12th, 2008, Randy defended his dissertation.