5-2012

Color Them Pink: An exploratory study of women and other underrepresented minorities in Master's STEM programs

Maggie J. Jobes
University of Nebraska-Lincoln, mjobes23@gmail.com

COLOR THEM PINK: AN EXPORATORY STUDY OF WOMEN AND OTHER UNDERREPRESENTED MINORITIES IN MASTER'S STEM PROGRAMS

by

Maggie J. Jobes

A THESIS

Presented to the Faculty of

The Graduate College at the University of Nebraska

In Partial Fulfillment of Requirements

For the Degree of Master of Arts

Major: Educational Administration

Under the Supervision of Professor Miles Taft Bryant

Lincoln, Nebraska

May, 2012

COLOR THEM PINK: AN EXPORATORY STUDY OF WOMEN AND OTHER UNDERREPRESENTED MINORITIES IN MASTER'S STEM PROGRAMS

Maggie J. Jobes, M.A.

University of Nebraska, 2012

Adviser: Miles Taft Bryant

This quantitative, exploratory study was designed to examine and compare socialization and mentoring in two groups of students, and the influence these factors had on their ranking of academic and overall experience in Master's degree level science, technology, engineering or math (STEM) programs at a large, Midwestern university. The subjects were University of Nebraska-Lincoln Master's degree recipients who had completed the Master's Degree Graduate Studies Exit Survey and had identified themselves as being part of a STEM graduate program. Literature displayed the underrepresentation of women and individuals of certain racial or ethnic backgrounds in STEM fields and particularly in graduate STEM programs. For this reason, subjects were divided in majority and minority groups based on their identification of gender and racial or ethnic background. Literature also suggested the importance of mentoring and socialization for the gender and racial/ethnic minority students and that the opportunities for this group, collectively, differ from those of the majority group. It was also stated that these factors are influential to the experience of graduate students and their probability to persist. Participants' responses on the Master's Degree Graduate Student Exit Survey were used to explore the two groups' mentoring and socialization experiences and the influence of these on ranking of academic and overall experiences at the University of Nebraska-Lincoln. When the academic and socialization

experiences of majority and minority STEM students in this study were compared, no statistically significant difference was detected. It was also found in this study that mentoring and socialization were statistically significant predictors of academic experience for the STEM minority students, and academic experience was highly correlated to overall experience at the university.

ACKNOWLEDGEMENTS

I would like to take this opportunity to express my sincere gratitude to those who have supported and guided me through this experience. I also would like to thank those who provided me with the necessary information to complete this endeavor.

First, my advisor, Dr. Bryant, thank you for all of your time and energy the last two years as I worked through the degree program and especially, during the thesis. Your feedback and suggestions challenged me to dig deeper and significantly impacted both my final product and me. Thank you. Dr. Winkle-Wagner, thank you for your support and encouragement throughout the research and writing process. Also, for allowing me to use your classes as a platform for my research, I can't express how much I appreciate the time you gave me. Dr. Greisen, thank you as well for thoroughly critiquing my thesis and providing valuable insight.

Dr. Laurie Bellows, thank you for providing me access to the data needed in order to complete my thesis. Thank you also to Renee Rodriguez Batman for inspiring me with the idea to go down this research path in the first place. Renee, you have additionally been a wonderful mentor and teacher. Thank you for challenging me and encouraging me throughout my program.

Graduate Studies provided me with the opportunity to learn through both my research and assistantship on the recruitment team. The collaborative work environment and support of this office has been tremendous. I cannot begin to say thank you enough. Specifically, the recruitment team has been a second family. Justina Clark, Mandy Bergeron-Bauer, Morgan St. John, Bailey Andresen, Kat Williamson, and Kelli Kruger, thank you for being flexible

with me and supporting me through the thesis process as well as throughout my program. These friendships and sources of daily support made all the headaches bearable. Thank you.

Beyond the walls of the University, there are several people who also deserve recognition of my gratitude. Mom and Dad, thank you for your unconditional love and belief in me. I cannot put into words all you have done, but none of this would have been possible without you. My brother, Brook, thank you for your encouragement, and for providing me with a much-needed distraction at times. My dear friends, Lindsey, Meghan, and Brittanny, thank you for the continual reassurance and love no matter how many texts or phone calls went unanswered. Thank you also for the constant reminder of what is important and not to lose focus.

Finally, but most importantly, I want to thank my Lord and Savior, Jesus Christ. I was reminded more times than I can count of His abounding grace and sovereignty throughout my thesis writing process and in my graduate program overall. I am completely undeserving. Faith that my future lays 100% in God's hands was my comfort and strength the past two years, and I will never forget the lessons I have learned.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

TABLES

FIGURES

CHAPTER ONE

INTRODUCTION

Increasing diversity has remained a constant issue in higher education especially over the past two decades. According to the National Center of Education Statistics (2011), in 1976 there were approximately 1.6 million students enrolled in graduate programs across the nation of which 58 percent were male and 85 percent were White. By contrast, in 2009, 59 percent of the graduate student population was female and only 63 percent of graduate students were White (NCES, 2011). While a general increase has been apparent in overall graduate education, the appearance of underrepresented racial and ethnic minorities (URM) (African American, American Indian/Native Alaskan, Hispanic) in addition to women has been negligible in the fields of science, technology, engineering and math (STEM). Data published in the *Journal of Research in Science and Teaching* (Maton, Hrabowski, & Schmitt, 2000) and elsewhere (Trower & Chait, 2002; NCES, 2011) shed light on the disproportionate number of URM and women in these fields at the graduate level. Of the almost 100,000 Master's and Doctorate degrees granted in 2009, only 40 percent were awarded to women or an individual of racial or ethnic minority (women-34 percent; racial/ethnic minority-8 percent[1]) (NCES, 2011). By comparison, international students received an additional 41 percent of graduate degrees conferred. This leads the higher education community to ask, "Why do some students continue to be underrepresented?"

[1] *Note these items may add up to greater than 100 percent as individuals may fall into both a racial/ethnic minority and gender minority (women).

Part of the problem of women and individuals of certain racial and ethnic backgrounds continuing to be underrepresented in graduate STEM programs, is the number of undergraduate students receiving Bachelor's degrees in STEM fields. According to NCES (2011), only 15 percent of Bachelor's degrees conferred in 2009 were awarded to URM students and just 35 percent to women. It is then easy to conclude that part of the problem in the graduate fields correlates directly to the number of STEM undergraduate students of these demographics. However, there must be other factors as well. One area where higher education may look for answers to the question of underrepresentation in STEM is to the experiences of these minorities, gender and otherwise, within their department, institution and the community as a whole. This may give insight as to what changes could be made and what these students could be looking for out of their experience that is different from the general population. In doing this research, insight can be gained as to what is important for underrepresented students to persist in graduate STEM programs, and what these students need out of their experience. Previous literature exhibits the importance of socialization (Gardner & Barnes, 2007; Herzig 2004; Sallee, 2011; Tinto, 1993; Astin, 1985; Palmer, Davis and Thompson, 2010; Cole and Espinoza, 2008; Johnson-Bailey, Valentine, Cervero and Bowles, 2009) and mentoring (Cooper, 2000, Herzig, 2002, Hollenshead et al., 1994, Etzkowitz et al., 2000 all cited in Herzig, 2004; McGuir & Reger, 2003; Rose, 2005; Davidson and Foster-Johnson, 2001) among these underrepresented student populations in graduate STEM programs and creates a need for research to be done in this area.

Purpose

The purpose of this study was to examine the influence of socialization and mentoring on minority students' academic and overall experiences in Master's degree level STEM programs at a large, Midwestern university. In addition, the correlation to the experiences of the majority group (White and Asian males) was also explored. Such research could provide important information to STEM faculty and advisors. This information could also benefit graduate student development professionals in both the department and Graduate College impacting both graduate student recruitment and retention. The research for this study was based on graduate student responses gathered from a survey done by the Graduate College at a Midwestern L4/R institution (Carnegie Foundation, 2011). The survey used for this study was the Master's Degree Graduate Studies Exit Survey, created by the Graduate College for their use. The survey was comprised of 32 questions focused on the student's academic and social development as well as professional preparation during their time as a Master's degree student.

Research Questions

The primary question in this study was, "Do respondents report that the experiences of minority Master's degree students in STEM fields differ from the experiences of members of the majority group?" However, en-route to finding the answer to this question, the other following research questions were explored:

1. How do minority students rank their academic experience at this university as compared to the majority?
2. Do the participants report the advice received from an adviser influences the way minority students feel about their academic experience at this university?

3. Do minority students report receiving the same socialization experiences as students who are members of the majority and does that influence their academic experience?

4. How does the academic experience of minority students correlate with their overall experience at this university?

Definition of Terms

As many of the terms to be used here may have multiple definitions, below are the definitions by which will be used for purpose of this study:

STEM- STEM is an abbreviation for science, technology, engineering, and math. In this paper, the term STEM includes all fields as recognized by the National Science Foundation (2011). These fields include:

- Biological Sciences (molecular, cellular, and organismal biology, environmental science)
- Computer and Information Science and Engineering (fundamental computer science, computer and networking systems, and artificial intelligence)
- Engineering (bioengineering, environmental systems, civil and mechanical systems, chemical and transport systems, electrical and communications systems, and design and manufacturing)
- Geosciences (geological, atmospheric and ocean sciences)
- Mathematical and Physical Sciences (mathematics, astronomy, physics, chemistry and materials science)
- Social, Behavioral and Economic Sciences (neuroscience, management science, psychology, sociology, anthropology, linguistics and economics)

- Education and Human Resources (science, technology, engineering and mathematics education at every level) (The Institution for Advanced Learning and Research, 2011).

Socialization- Socialization, as it relates to graduate education, is best viewed through the lens of organizational socialization (Gardner & Barnes, 2007, p. 371), which is defined by Van Maanen and Schein (1979) as "the process by which an individual acquires the social knowledge and skills necessary to assume an organizational role" (p. 211). In short, the process of socialization could also be defined as assimilation to a particular culture as Van Maanene and Schein (1979) also describe it as "the transmission of information and values" (p. 210).

Minority- In culture today, the word minority often is only inclusive of racial or ethnic minorities. For the purposes of this research, minority was defined as "the smaller number in two groups constituting a whole" and "a part of a population differing from others in some characteristics and often subjected to differential treatment" (Merrium-Webster Dictionary, 2011). The minority group for this study includes women (the gender minority in STEM) and racial or ethnic minorities (American Indian, Hispanic/Latino and African American students), as this group constitutes less than 40 percent of Master's and Doctoral degrees granted in 2009 (NCES, 2011). As students may fall into more than one of these categories, they will be discussed and researched as a whole.

Hypotheses

Hypothesis Examining Minority and Majority Academic Experience

H_1: Master's degree students who are considered a minority in STEM fields rank their academic experience the same as students in the majority.

Hypothesis Examining Relationship Between Adviser and Academic Experience

H_2: The advice received from an adviser by minority students in Master's level STEM programs does not relate to how they rank their academic experience.

Hypothesis Examining Minority and Majority Socialization

H_{3a}: Minority Master's degree students have the same socialization experiences as members of the majority.

Hypothesis Examining Minority Overall Experience

H_4: Academic experience does not directly correlates to the overall experience of the minority student population in Master's degree level STEM programs.

Limitations

The results of this study may have multiple limitations. First, among the surveyed participants, there were not enough students of a racial or ethnic minority to be studied as a separate group from the gender minority. Because of this, while assumptions may be made about the group in its entirety, the accuracy in doing so may be limited. Additionally, international students were included in each population group. The presence of their perceptions in the data may slightly skew its overall effectiveness.

The structure of the survey itself also creates limitations. The survey was not required of the population or all Master's degree recipients thus creating potential disproportional populations of respondents. Students who did choose to take the survey also did not have to answer every question. Furthermore, as gender was cued to be the

first independent variable, students who did not answer this question were automatically disqualified from inclusion in the population.

Significance of Study

The research done in this study is significant for multiple reasons. First, the results pertain specifically to gender and racial or ethnic minorities in certain disciplines. Additionally, the fields studied, STEM, are "the most elite and influential sectors of the U.S. labor force" (Hanson, 2004, p. 96), making them valuable assets to the university. These results may aid the university in recruiting and retaining these students in these disciplines and could potentially lead to further research in other programs. Furthermore, this research is in line with the National Science Foundation's (NSF) legislative engagement to "Support activities designed to increase the participation of women and minorities and others underrepresented in science and technology" (2011).

Summary

Knowing that women and students of color have continually been underrepresented in graduate STEM programs as is evident through research (NCES, 2011; NSF, 2011; Maton, Hrabowski, & Schmitt, 2000; Trower & Chait, 2002), the higher education community along with the NSF are looking to make changes in order to potentially open doors for these minority students. The research done in this study hopes to create insight to the importance of the experience in meeting these goals of enrollment and persistence. Continuing, Chapter 2 provides a review of literature related to the study of gender and racial or ethnic minority students, with the previous studies focusing primarily within STEM disciplines and/or graduate education. Chapter 3 will include an explanation of how the research was conducted and analyzed while Chapter 4 provides a

detailed explanation and discussion of the study's results. Finally, the implications of this study and suggestions future research will be in Chapter 5.

CHAPTER II

LITERATURE REVIEW

The purpose of this exploratory study was to examine the influence of socialization and mentoring on minority students' academic and overall experiences in Master's degree level STEM programs at a large, Midwestern university. The focus of this chapter is to review the significant areas of literature on which this study is based. The literature review is divided into four sections: Methodology, The Women's Experience, The Racial/Ethnic Minority Experience, and Conclusion.

Methodology of Literature Review

The search for this literature was primarily done through electronic, academic search engines available through the University of Nebraska-Lincoln libraries, including Project Muse, JSTOR, Google Scholar and Education Resources Information Center (ERIC). Search terms for these avenues of research included: graduate students, STEM, women in science, women in math, women in engineering, African American graduate students, Hispanic/Latino/Latina graduate students, diversity in STEM, minorities in science and minorities in math. The first and primary search term was graduate students as the experiences of graduate students are truly different from that of an undergraduate student. The terms related to diversity came second. In looking for research directly related to graduate students, there was very little available, and even less relating directly to the STEM fields. The literature pertaining to women focuses mainly on the track to faculty and much of the literature pulled was written specifically about the misrepresentation of women faculty in STEM fields. Additionally, the literature

published about Hispanic/Latino students continues to be minimal as is research related to African American males. This is reflected in the disparity of literature on minority graduate students in general. Therefore, because of the dismal amount of articles and studies, inferences and literature had to be used from some research done with undergraduate students.

The Women's Experience

Historically, women have been highly underrepresented in the fields of science, technology, engineering and mathematics (Sax, 2001; NSF, 2008; Herzig, 2004; Bystydezienski, 2004; NCES, 2011). This has led many researchers to take an objective look at what is keeping women from entering these disciplines. While an abundance of research has been done to look at the hindrances among undergraduate students (Garforth & Kerr, 2009; Kohlstedt, 2004; Hanson, 2004; Rosser, 2002; Kirk, 2002), little is known about the post-baccalaureate education of students who did pursue a Bachelor's degree in a STEM field (Sax, 2001, p. 155). Information put out by the U.S. National Science Foundation (2008) suggested barriers to women in entering graduate education in these fields, as only 40 percent of the full-time STEM graduate students nation-wide were female. Bystydezienski (2004), using this NSF data in a literature review, posed a challenge to STEM programs: Instead of trying to fit women into existing departments, programs and laboratories, maybe it is these exact entities who should make the changes. The question then remains, "Where are the obstacles that need to be removed in order for more women to enter and complete graduate degrees in STEM?" The following literature focuses on three obstacles for women in science, technology, engineering and

math disciplines: the balance of family and school, socialization and mentoring. Critiques of the literature will lie there in as well.

Familial Obstacles

Reviewed literature focused on familial barriers for women scholars in STEM graduate programs, including the issues of a ticking biological clock, child-care options and the overall wanting of a family (Rosser, 2004; Valian, 2004; Herzig, 2004). These studies came from other reviews of literature, data analysis and qualitative analysis. Using an e-mail survey of open-ended questions to science recipients of the Professional Opportunities for Women in Research and Education (POWRE) grant, Rosser (2004) in a qualitative study found that one of the biggest issues facing women is the balance between career and family (p. 57). The issue of a woman's ticking biological clock came into question in Rosser (2004), inferring that among women pursuing a Ph.D. the issue is much greater as the degree program is longer. This could also extend to the issue of persistence within the program as 62 percent of women scientists are married to male scientists and it is shown that usually it is the woman's career that is put on hold (p. 63-64). Additionally, Herzig's (2004) literature review discussed the light in which women with families are seen. She stated, "Women graduate students in science who marry or have children have been viewed as not serious about their studies, or as unreliable and not worth the investment; men who marry or have families do not face the same biases" citing Etzkowitz, Kremelgor and Uzzi (2000) (p. 189). Suggested changes could include family-friendly policies, such as on-cite daycare or service-modified duties (i.e., time off, less time in the lab, etc.) around the time of birth or adoption as illustrated by the University of California system (Rosser, 2004,p. 63).

The removal of such obstacles as these was made a priority by the University of Nebraska-Lincoln, thus increasing the number of mathematics graduate degrees conferred to women (Herzig, 2004, p. 202-204). This department also specifically developed programs for not only women graduate students, but younger women as well to encourage an environment of inclusiveness and encouragement, as is deemed necessary by literature in the following sections. The Rosser (2004) and Valian (2004) articles offer valuable insight into the world of a Ph.D. student; however, fall short in marking the degree to which balancing family and school factors into a Master's student's experience. Valian's study specifically did not focus on human participation or opinions, but rather had a foundation in psychology, offering a different view into institutional and discipline gender inequality. Furthermore, findings of these articles pertained directly to faculty and those who had already started their careers and could have offered more methods of potential change for institutions. Herzig's (2004) literature review filled the gaps of the previous authors' works by portraying the bias women face in family obligation as it relates to specifically to men and other minorities, but the author's focus only within the math field poses limitations on the effectiveness of her compilation. Each of these articles could further discuss barriers the institution could remove or prevent, and they could offer perspective to a broader audience through expansion of the discipline or people studied. The literature here also provides only a limited scope of what could be done in that compilations of other's literature and qualitative studies do not show statistical or longitudinal significance for this issue.

Socialization

The socialization of graduate students also has been a major topic in literature

regarding gender and STEM fields, having been looked at through literature reviews and qualitative studies. Socialization, as it relates to graduate education, is best viewed through the lens of organizational socialization (Gardner & Barnes, 2007, p. 371). Citing VanMaanen and Schein (1979), Gardner & Barnes (2007) stated that organizational socialization is "the process by which an individual acquires the social knowledge and skills necessary to assume an organizational role" (p. 371). From a young age, women's socialization leads them to look for interaction, attention, and reinforcement in organizations rather than being independent and autonomous as a male is so inclined (Etzkowitz et al., 2000 and Fennema & Peterson, 1985 as cited in Herzig, 2004, p. 186). Herzig (2004) stated in her literature review that women's socialization within math fields could be limited, as a predominantly male faculty would feel such interactions are inferior and thus offer support and further connections primarily with male students (p. 186).

Gardner and Barnes (2007) cited Golde's (1998) qualitative study of interviews in describing the socialization process of a graduate student as one "in which a newcomer is made a member of a community—in the case of graduate students, the community of an academic department in a particular discipline" (p. 371). Sallee (2011) offered greater insight into socialization of graduate students through observation and interviews over the course of six months in a qualitative study with faculty and students in a male-dominant Aerospace and Mechanical Engineering department. Her study focused on "the ways that the disciplinary culture encourages both male and female students to adopt a particular set of values in order to succeed" (p. 188). These observations are influential to the socialization process as Gardner and Barnes (2007) stated that through their study's

interviews, it became apparent that involvement with peers and faculty through class, the department and the discipline's community as a whole, highly influenced socialization. Sallee in engineering (2004) and Herzig (2011) in math suggested these fields favor masculinity, which is tied to "intellectualism and independent discovery mixed with a strong dose of competition and hierarchy" (Sallee, 2004, p. 209). Both authors clearly depict the culture of socialization in male-dominant STEM fields, while Gardner and Barnes's (2007) goal was to show the reader how important involvement with peers and faculty was to socialization. Herzig's (2004) literature review primarily outlined the discipline of math, but did offer some insight into computer science and engineering, while Sallee's (2011) study was completely focused within the Aerospace and Mechanical Engineering department. The outline of men and women's socialization experiences was clear and detailed in both discipline specific articles, but Sallee (2011) only had two females among her student participants, which could lead to questions of legitimacy, as could the limited number (10) of participants in Gardner and Barnes's (2007) study. Also, racial and ethnic demographics were excluded from Sallee's overall research, limiting its breadth. While these demographics were included in Gardner and Barnes's (2007) research, little discussion came of them after being listed. Additionally, some biological and civil engineering fields are less segregated in gender than math and aerospace and mechanical engineering, and additional gender socialization research should be done in these departments to determine what is valued. Overall, researchers should utilize quantitative methods in addition to the qualitative research and literature currently available.

Mentoring

The final area of women's literature to discuss is mentoring, which as been identified as a factor in experiences through quantitative studies and inferences from other literature. Mentors for graduate students are incredibly valuable in the provision of moral support and encouragement as well as discipline-related advice (i.e., politics of field, "how to play the game", etc.) (Cooper, 2000; Herzig, 2002; Hollenshead et al., 1994; Etzkowitz et al., 2000 all cited in Herzig, 2004, p. 191; McGuir & Reger, 2003)). This is particularly applicable to females as Rose (2005) stated in her quantitative study of doctoral students that women graduate students rate role modeling and professional ethics as more important than male students (p. 74). These studies exhibit the importance of mentoring; however, McGuir and Reger's (2003) literature review and program proposal stated that, "In some departments there is also a shortage of mentors interested in working with students…from underrepresented groups," (p. 58) which, in STEM disciplines, would include women. As faculty or advisors feel the need to mentor students in his or her same network (i.e., gender or other minority group), limited time and attention is given using the traditional mentoring model as there are too many students to be served by a limited number of mentors (McGuir and Reger, 2003, p. 59). For this reason, McGuir and Reger (2003) proposed a peer "co-mentoring" program, which "fosters an equal balance of power between participants, seeks to integrate emotion into the academic professional experience, and values paid and unpaid work" (p. 54). The mentoring literature is expansive, but only when looking at the importance of mentoring; very little is that which discusses the experiences students had from a "birds-eye-view." Herzig (2004) discussed why women need mentors in a literature review format, Rose (2005) discussed what was important in a mentor from a gender perspective

through a study of what males and females deem important in a mentor, and McGuir and Reger (2003) were advocates of a co-mentoring program, which does not offer the discipline or academic advice and perspective needed. Research needs to be done from the perspective of previous graduate students and their experiences with and without mentors; this would offer insight into the value of these relationships. Additionally, mentor/mentee relationships could be examined from a perspective of a formalized program versus "unspoken" relationship. In all, the quantitative research provides a solid foundation for the literature reviews while qualitative methods could be utilized in order to more fully explain the importance of the mentor/mentee relationship.

The literature surrounding women in science, technology, engineering and mathematics graduate programs shines a light on the gender disparity of these fields. The influence family, socialization and mentoring have on the experiences of these students prove to be influential to say the least. Overall, these disciplines need to make environmental changes in order to create a warmer climate in their respective fields. Gaps in literature do provide areas for future quantitative and qualitative research to be done in the areas of mentor/mentee relationships, socialization in other engineering and technology fields as well as barriers that could be removed by implementing new programs and services for women with families. Additionally, specifying between doctoral and master's degree candidates could be beneficial as their experiences may differ. The reviews of literature would provide a foundation for which this research could be done. These three topics in literature may expand to underrepresented racial or ethnic minorities as well, but clearly can be seen in the women's experiences in STEM graduate programs.

The Racial/Ethnic Minority Experience

In addition to an under representation of women in STEM graduate programs, there are also a limited number of underrepresented minority (URM), specifically African American and Hispanic students, in these disciplines (NSF, 2011; NCES, 2011). While this continues to be a growing issue, the literature related directly to the African American and particularly the Hispanic/Latino graduate student population overall, is limited. In regards to these demographics in STEM disciplines, there is additionally a major deficiency in literature and published research. Therefore, in addition to the limited literature available, material regarding minority students in graduate school and STEM disciplines will be applied to outline the experiences of these URM graduate students in science, technology, engineering and math programs.

African American Women

One area where there were numerous articles related directly to African American women in science fields and, using qualitative research, discussed how they may be potentially better suited for STEM programs because of certain attributes (Hanson, 2004) but still experience biases and are perceived as outsiders (Beoku-Betts, 2004). As cited in Hanson (2004), Higginbotham and Weber (1992) found that "African American families put a greater stress on education and occupation as sources of mobility for their daughters (relative to white families)" as marriage is not viewed as a source of mobility in society (p. 99). This should equate to larger percentages of women in STEM as Hanson (2004) stated these fields are "the most elite and influential sectors of the U.S. labor force" (p. 96). Within their race, African American women received over half of master's degrees in science and engineering and almost half (46%) of Ph.D.s (Hanson, 2004, p. 100).

However, while these percentages are high, the actual number is relatively low, as it was previously stated that racial/ethnic minorities overall only received approximately 8 percent of masters and doctorates (NCES, 2011). Using a qualitative survey and tracking/comparing African American and white women from 8th grade through their postsecondary education, Hanson's (2004) longitudinal study found that African American women tend to have better experiences than white women in science, engineering and math programs as many of their attributes are more evenly matched with those required in STEM fields, such as self-esteem, independence, assertiveness and high expectations (p. 106). Herzig (2004) attributed confidence, talent and ability to these characteristics important in STEM disciplines in her literature review as well as stating that they contribute greatly to the persistence of graduate students (p. 187-188).

While having success in graduate programs because of their character attributes, African American women are not immune to prejudice. Beoku-Betts (2004) used interviews with native African women serving in academia in their home countries to illustrate the gender and racial biases these students are subjected to, which pushes them to be viewed as "outsiders." They experienced the same gender biases as white women in terms of family and sexism, but were consistently trying to affirm their ability as scholars (p. 122-123). The Beoku-Betts (2004) article and Hanson (2004) study offered valuable insight to the crossing of gender and race in graduate science, engineering and math programs. Hanson's (2004) comparisons and research of African American to white women particularly illustrated the differences in their experiences, while Beoku-Betts (2004) examined the ways in which the two groups were similar. Herzig's (2004) literature review affirmed almost all of their findings. While exhibiting benefits to the

field, this research also had limitations. Neither author gave examples of good or bad experiences within students' respective programs, nor did Hanson really did not speak directly about graduate students. Additionally, excluding men and other nationalities from these two studies may have been necessary, but also limits the use of this research as they still account for at least half of the URM population within STEM fields. Beoku-Betts's study also focused only on international graduate students, so domestic women of African decent were excluded. Additionally, Herzig (2004) spoke primarily of women, but not of colored women. Each piece has strengths and weaknesses using qualitative methods but overall, further quantitative research could expand their reach.

Socialization

Literature and research pertaining to the African American race as a whole focuses on a couple of areas- one being socialization. As stated previously, Gardner and Barnes (2007) cited Golde's (1998) study in describing the socialization process of a graduate student as one "in which a newcomer is made a member of a community—in the case of graduate students, the community of an academic department in a particular discipline" (p. 371). Both Tinto (1993) and Astin (1985) discussed the value engagement and involvement of students (part of socialization) has on academic success. Palmer, Davis and Thompson's (2010) literature review examines this research and how it pertained to STEM initiatives, particularly at historically Black colleges and universities (HBCUs). Palmer et. al. (2010) found that STEM programs and initiatives set forth by the institution aided in helping the students adapt to "the rigors of the STEM curricula and expectations of faculty and introduce them to support resources that can help them maximize their potential" (p. 442). Additionally, the mentoring component of these

STEM initiatives at the HBCU offered a sense of support for the student and enhanced their commitment to the university. The importance of initiatives within the discipline is vital for minority students, as in their study of Latino students using longitudinal quantitative survey data analysis provided by the Cooperative Institutional Research Program (CIRP), Cole and Espinoza (2008) found that these students may seek a connection through involvement outside of their major, the connection can jeopardize the students' academic performance (p. 297). However, Johnson-Bailey, Valentine, Cervero and Bowles (2009) utilized both qualitative and quantitative methods in a study of African American graduate students at a Southern predominantly white institution (PWI) using a survey and focus groups to examine these student experiences in a very different setting. The survey of Johnson-Bailey et. al. (2009) study showed that over the course of 40 years (the 1960s through the 1990s) white faculty discrimination has decreased while white student discrimination has increased (p. 191-192). This led to the students feeling socially isolated and forced to speak often on behalf of their race as a whole (p. 192). The interviews illustrated feelings of, again, isolation, loneliness, disconnection and being discriminated against, leading the graduates to say their experience was more something they had "endured and survived" (p. 197). These findings brought the authors to the conclusion that,

> "Without hesitation, our politically infused theoretical framework leads us to assert that unless the University—and more importantly its graduate programs—begins to consider and intentionally make efforts to positively impact the social experiences of their Black graduate students, this group of students will continue to have a less than optimal graduate experience."

These first two articles offer a limited view of what a graduate student's socialization experience could be as Palmer et. al looked specifically at and HBCU, where African American students would not be a minority, and Johnson-Bailey et. al, where a Southern PWI was studied, which could offer a more hostile environment because of the South's history than a PWI located in another part of the country. Other environments geographically need to be considered in order to get a comprehensive view of experiences. Additionally, it is difficult to compare the two research findings as Johnson-Bailey et. al. did not look at STEM programs specifically but the African American student population as a whole. An additional limitation of this study, looking at other STEM literature, is only 6.8% of participants were in a STEM discipline, though it is easy to conclude their feelings would be consistent with the rest of the population at this institution. Palmer et. al. could expand their research to other HBCUs and PWIs with STEM initiatives, and Johnson-Bailey et. al. could expand to other PWIs in different geographic locations. The Palmer et. al. (2010) literature review, Cole and Espinoza (2008) longitudinal quantitative study, and Johnson-Bailey et. al. (2009) quantitative and qualitative research do provide a cohesive foundation for further research and give a comprehensive analysis of the environmental influences on the experiences of racial and ethnic minority students in STEM graduate programs.

In order to avoid the socialization experience presented at the Southern PWI and to give an example of socialization for URM graduate students such as African American and Hispanic students, Granados and Lopez (1999) described the development, implementation, and assessment in a program proposal format relative to the Graduate Mentorship Program (GMP) in the School of Education at the University of California-

Berkeley, which addressed these issues and now provides a support system for URM students. The literature review in this article reiterated the potential issues URM graduate students face, such as isolation, racism, sexism, and having to speak for their entire race or ethnicity. Among other things, the program offers mentoring with a faculty member or more advanced graduate student to create a sense of community at the new institution, a resource and information center available to provide information on social, academic and professional opportunities, and the implementation special programs and workshops providing information about academic and professional skill development. This program creates a graduate student experience that is impactful and beneficial to the student as well as the department and institution. A current update on this program would be necessary in order to evaluate its effectiveness. In addition, if something similar has been or could be done in the STEM disciplines, it would be interesting to note the changes or differences between them and what could or would work. It is included here as another example of the type of experience African American graduate students could have.

Like the University of California-Berkeley program, Davidson and Foster-Johnson (2001) stated in a literature review they believe mentoring is critical in minority graduate student success as these relationships "integrate a student into the fabric of the department, cultivate essential professional and social networks, aid students in acquiring core research competencies, and pave the way for placement in the work force upon matriculation from graduate school" yet many times URM students do not have these socialization opportunities (p. 549-550). Cole and Espinoza's (2008) longitudinal research agreed with the importance of mentoring citing Hernandez and Lopez in their statement that, "Students who foster relationships with faculty members outside of the

classroom are more likely to report higher levels of college satisfaction and persist to graduation" (p. 286). Through their quantitative analysis of data collected by a higher education research institute, Cole and Espinoza (2008) found that additional support through diversity/multicultural student groups, as proposed in the UC-Berkeley program, may be used in response to feelings of alienation and marginalization experienced within their academic programs but can have a harmful effect on their grades. Davidson and Foster-Johnson (2001) urge both cross-cultural and same-race mentoring as well as further research to be done to indicate the benefits or limitations of same-race mentoring, as the challenges of cross-cultural mentoring have already been noted. These authors could provide further evidence to back up their claims through their own research outside of just a literature review. This would instate another element of credibility to their work. Mentoring is obviously a vital element of the graduate student socialization experience, and could potentially make or break an URM graduate student's academic career. While neither the literature review or program proposal relate directly to STEM disciplines, they are important to the field and give a clear illustration as to "what could be" as far as socialization for African American and other minority graduate students.

Overall, research pertaining to underrepresented minority STEM graduate students is limited, and the Latino/Hispanic student literature makes up a mere fraction of the little literature available. For this reason, literature was included here related to the African American graduate student population, both Hispanic and African American STEM students in general, and the underrepresented minority population in its entirety in multiple fields, as inferences can be made from these areas for specific racial and ethnic minority graduate students in STEM disciplines. This reveals large gaps in research in

ethnicity, geographically and discipline specific. The breadth of methods used in racial and ethnic minority research does create a basis for future research, and the literature reviews, quantitative and qualitative analysis secure a sense of credibility for the field as numerous aspects and views are examined. In general, future research needs to look at the Hispanic population as they are the largest minority group in the nation and will continue to grow (Reddy, 2011). Additionally, more should be done to examine how African Americans, particularly men, are fairing in science, technology, engineering and math programs today as they still represent half of the race's students receiving graduate degrees in these fields.

Conclusion

Based on the current literature, it is evident that the experiences of women and underrepresented minority students in science, technology, engineering and math graduate programs leave much to be desired. There were many common themes evident in the literature across the board including the importance of mentoring, socialization and unbiased faculty and peers. While these areas of emphasis were apparent throughout, there is still much work to be done in these fields. A great deal of research focuses on the undergraduate experiences and climate for minorities (including women) in STEM programs, but very little research has been done with a focus on graduate students in STEM. Also, literature was easy to find regarding women, but increasingly difficult to find regarding African American and Hispanic graduate students. Only one article was available regarding Hispanic students and it looked primarily at STEM students as a whole, written seemingly with an emphasis for undergraduate researchers. That being said, the research related to students of a racial or ethnic minority did provided the

greatest breadth of methodology thus creating a firm foundation for other research to build upon. On the other hand, methodology in research being done relative to women in STEM needs to develop as both quantitative and qualitative analysis would create a balance and add more credibility to the field, as current qualitative methods have not provided a sustentative base for further research. Without the broad-based foundation available, it is no wonder there is a limited about of research done with graduate students in STEM fields. It was also interesting not to find any information on funding or the impact publishing articles or research may have on the graduate students' experiences. These are important parts of STEM programs and the development of graduate students. The research conducted in this thesis hopes to expand upon these points in addition to the ideas of mentoring as provided by an advisor and socialization as it relates particularly to Master's students and how these factors correlate to the overall experiences of these students in the science, technology, engineering and math fields.

In the next chapter, the purpose and details of this study are further discussed. The methodology, population studied and instrument used are described. Additionally, the study's hypotheses and data collection procedures used are presented.

CHAPTER THREE

METHODOLOGY

Purpose

The purpose of this study was to examine the influence of socialization and mentoring on minority students' academic and overall experiences in Master's degree level STEM programs at a large, Midwestern university.

Setting

Research for this study was conducted at the University of Nebraska—Lincoln (UNL), a large (approximately 25,000 students,) four-year, public, research institution located in a Midwestern city. The University of Nebraska—Lincoln 2011-2012 Fact Book states that, "The role of the University of Nebraska-Lincoln as the primary intellectual and cultural resource for the State is fulfilled through the three missions of the University: teaching, research, and service" (2011, p. 5). The University of Nebraska-Lincoln is recognized by the state legislature as the primary research and doctoral degree granting institution for the state and is classified as a Research Intensive University with very high research activity (Carnegie Foundation, 2010), awarding baccalaureate, masters, and doctoral degrees. Graduate students represent 19 percent of the total student population, with Master's degree candidates accounting for 75 percent of graduate degree recipients (UNL Fact Book, 2011, p. 17).

Research Design

The research is quantitative and the data were gathered through the Master's Degree Graduate Studies Exit Survey, developed by the University of Nebraska-Lincoln

Graduate College. Surveys were distributed via email, and collected and tabulated online by the Graduate College after commencement in May 2010, August 2010, December 2010, May 2011, and August 2011. This survey was first distributed in May 2010.

Population and Sample

Through the five distributions of this survey by the Graduate College to all Master's degree students post-graduation, approximately sixteen hundred University of Nebraska-Lincoln Master's degree graduates received the e-mail invitation to participate in this survey. Of the sixteen hundred students invited to participate, six hundred and forty anonymous responses (40%) were collected. Among the respondents 167 met the criteria for this study, that being they were a Master's degree student in a science, technology, engineering, or math (STEM) discipline, and had distinguished themselves as a male or female in responding to the survey (N=167). These respondents were then classified by gender and racial or ethnic background. White and Asian males were established as the majority group and accounted for 54 responses (N=54). The minority group established consisted of 67 females and five African American or Hispanic males (N=72). As stated in Chapter I, for the sake of this study the minority group included all traditionally underrepresented populations in STEM programs. Forty-one male respondents did not distinguish their ethnicity and thus their identity as a majority or minority group member could not be characterized.

Table 1
Group Respondents and Percentages

Membership	Number of Respondents	Corresponding percentage
Minority	54	32.3%
Minority	72	43.1%

Several characteristics of the sample were notable. Male respondents were underrepresented in comparison to the total number of male Master's students in STEM graduate programs at the University of Nebraska-Lincoln, according to the University of Nebraska-Lincoln Enrollment Index (2011). The demographic percentages of racial and ethnic minorities, however, were parallel to that of the STEM disciplines institution wide (UNL, 2011). The following table (Table 2) presents demographic characteristics of race and ethnicity of UNL Master's STEM students who completed the Master's Degree Graduate Studies Exit Survey compared to all 2010-2011 University of Nebraska-Lincoln STEM Master's degree graduates and Master's Degree recipients as a whole, by percentage.

Table 2
Comparison of Gender, Race and Ethnicity by Percentage for Survey Respondents, UNL STEM Master's Degree Graduates, and UNL Master's Graduates

		UNL STEM Master's Degree Exit Survey Respondents	UNL STEM Master's Degree Graduates	UNL Master's Degree Graduates
Gender	Male	35%	61%	47%
	Female	40%	39%	53%
Race/Ethnicity	American Indian	.6%	.4%	.1%
	Asian	1%	10%	5%
	Black or African American	4%	6%	2%
	Hispanic/Latino	3%	1%	2%
	Multiracial	0%	.4%	.5%
	White	57%	60%	73%

Non-US Citizen	28%	17%	11%

*Prefer Not to Respond and Race and Ethnicity Unknown responses not included in Race/Ethnicity

This table illustrates several characteristics; the first being the percentage of this institution's STEM graduates that are male compared to female is significant to the purpose of this study, as it illustrates the disparity discussed in previous literature. It is also evident that many respondents did not mark their race or ethnicity in the institutional data. Additionally, it is now clear the disparity of male respondents to the Master's Degree Graduate Studies Exit Survey compared to the population number that should be represented. The proportion of female respondents is parallel to the STEM Master's degree female population as illustrated by the University of Nebraska-Lincoln's institutional data (2011). The discrepancy is also visible in the number of Non-US Citizens who responded to the survey in comparison to the percentage of the population that should be represented in this category.

Instrumentation

The instrument used in this study was the Master's Degree Graduate Studies Exit Survey (Appendix A). It was developed by the University of Nebraska-Lincoln Graduate College in 2010 to aid in the assessment of individual graduate programs (Office of Graduate Studies, personal communication, October 2011). The first survey was sent to Master's degree recipients after commencement in May 2010 and was subsequently sent to degree recipients following graduation up through the present. The survey consists of twelve sections:

1. Introduction
2. Overall Satisfaction

3. Training Program/Program Quality
4. Support
5. Faculty Mentoring and Advising
6. Professional Development
7. Level of Engagement/Preparation
8. Outcomes
9. Career Plans
10. Demographic Information
11. Ethnicity Information of U.S. Citizens
12. Additional Comments

For the purposes of this study, seven sections were utilized: Introduction, Overall Satisfaction, Faculty Mentoring and Advising, Level of Engagement/Preparation, Outcomes, Demographic Information, Ethnicity Information of US Citizens. Participants' subjective responses were evaluated in four sections: Overall Satisfaction, Faculty Mentoring and Advising, Level of Engagement/Preparation, and Outcomes.

The Introduction section of this survey consists of four questions to assess the degree program area of the participant's study followed by Overall Satisfaction where the respondent ranks their academic, student life and overall experience at the university. The Faculty Mentoring and Advising section includes ranking questions on the helpfulness and timeliness of the faculty adviser's advice in 18 areas. Level of Engagement/Preparation and Outcomes were used in this study to measure socialization. The first targeted the research experience of respondents asking about the number of research presentations made and if they had any research published or under review. The

latter asked the participant to rank the preparation they received in acclimating to their discipline. Demographic Information and Ethnicity Information of US Citizens allowed the respondents to categorize their gender, citizenship status, and racial or ethnic background.

As with all instruments and research designs, validity and reliability of instrumentation must be questioned, as, according to Kuh (2001), validity is the most important quality of an assessment tool (p. 5). The Master's Degree Graduate Studies Exit Survey was distributed to all Master's degree recipients post-commencement. There was not a reward or motivation for participation and all responses were self-report. In Kuh's (2001) conceptual overview and assessment of the National Survey of Student Engagement, arguably one of the largest and most used college student surveys, the author asserted the necessity of self-repot data as "outcomes of interest cannot be measured by achievement tests, such as attitudes and values or gains in social and practical competence" (p. 3). According to Kuh (2001), self-reported data is likely to be valid under five general conditions: (1) Requested information is known by the respondent; (2) The questions asked are clear in meaning and cannot be misunderstood; (3) The questions refer to recent events or activities; (4) The respondents believe the questions merit serious and thoughtful responses; and (5) Answering does not threaten, embarrass, or violate the privacy of the respondent or encourage them to respond in socially desirable ways (Bradburn & Sudman, 1988; Brandt, 1958; Converse & Presser, 1989; DeNisi & Shaw, 1977; Hansford & Hattie, 1982; Laing, Swayer, & Noble 1989; Lowman & Williams, 1987; Pace, 1985; Pike, 1995 as cited in Kuh, 2001, p. 3-4). The Master's Degree Graduate Studies Exit Survey meets these five criteria.

Kuh (2001) defined the reliability of an instrument as the degree to which a set of items consistently measures the same thing across respondents (p. 5). He also stated that stability, or the degree to which participants respond in similar ways at two different points in time, was a characteristic of a reliable instrument (p. 5). While the Master's Degree Graduate Studies Exit Survey measures the same criteria across respondents, stability, as defined by Kuh (2001), is not an element that could not be measured using this survey and population. However, based on Kuh's (2001) criteria, this instrument can be deemed valid and reliable.

The survey questions in each of four subjective response categories measured respondent mentoring, socialization, and overall satisfaction with the institution. However, once demographic and program information was included as an assessment tool, the survey could be used to measure the how majority and minority groups were being served by departments. Coordinating the findings in this manner allows for better assessment and evaluation of academic departments; in the case of this study, it is the examination of STEM disciplines.

Research Question

Do respondents report that the experiences of minority Master's degree students in STEM fields differ from the experiences of members of the majority group?

Sub Questions

1. How do minority students rank their academic experience at this university as compared to the majority?
2. Do the participants report the advice received from an adviser influences the way minority students feel about their academic experience at this university?

3. Do minority students report receiving the same socialization experiences as students who are members of the majority and does that influence their academic experience?

4. How does the academic experience of minority students correlate with their overall experience at this university?

Hypotheses

This study examined four hypotheses.

Hypothesis Examining Majority and Minority Academic Experience

H_1: Master's degree students who are considered a minority in STEM fields rank their academic experience the same as students in the majority.

Hypothesis Examining Relationship Between Adviser and Academic Experience

H_2: The advice received from an adviser by minority students in Master's level STEM programs does not relate to how they rank their academic experience.

Hypothesis Examining Majority and Minority Socialization

H_{3a}: Minority Master's degree students have the same socialization experiences as members of the majority.

Hypothesis Examining Minority Overall Experience

H_4: Academic experience does not directly correlates to the overall experience of the minority student population in Master's degree level STEM programs.

Data Collection Procedures

The researcher began the study by requesting to use the data gathered through the Master's Degree Graduate Studies Exit Survey from the University of Nebraska-Lincoln Graduate College. Permission was granted through email from the college's Assistant Dean (Appendix B), and Institutional Review Board exemption approval was obtained

from the University of Nebraska-Lincoln Institutional Review Board (IRB #: 20120112409 EX) (Appendix C).

The Graduate College e-mailed the online Master's Degree Graduate Studies Exit Survey link to all Master's degree recipients after graduation in May 2010, August 2010, December 2010, May 2011 and August 2011. The responses were collected through an online forum and ready for analysis. The Graduate College provided the researcher access to survey responses through the password protected online response forum. All responses were aggregated and exported from the web to a secured file. After sorting the responses, it was determined that there was a sufficient number of STEM program respondents to continue with this study.

Data Analysis Procedures

This study analyzed the influence of socialization and mentoring on minority students' academic and overall experiences in Master's degree STEM programs. A comparison to the experiences of the majority group was also explored. The purpose of the analysis was to examine the experiences minority STEM students had compared to the majority in two areas: mentoring and socialization, as previous literature and research has revealed these focuses to be influential. Mentoring was examined through ranking the adviser's helpfulness and timeliness as socialization was explored through the number of research presentations made, articles published, and the student's ranking of their own engagement and preparedness.

For the purpose of this study, the researcher made arrangements to analyze the data collected with the Nebraska Evaluation and Research Center (NEAR Center). Upon initial analysis, 41 of the 96 male respondents did not characterize their race or ethnicity

and thus could not be included in the sample population for the majority or minority groups. Additionally as none of the questions were mandatory, some survey respondents did not answer each question. If the respondent did not have a predictor, they were excluded in the sample population for that question.

All survey responses for questions of rank were coded using a five-point Likert scale to assess consistency with a higher number equating to greater satisfaction. Independent sample t-tests using an alpha value of .05 were used to determine the significance levels for the research questions examining rank of academic and socialization experience. Multiple regression analysis was used to predict the adviser's influence on minority students' academic experience. Finally, a Pearson Correlation examined the relationship between the minority group's academic experience, as predicted by socialization and mentoring, and the population's overall experience.

The subsequent chapter describes the statistical results of this study in detail. Each hypothesis is examined and the corresponding findings are reported.

CHAPTER IV

RESULTS

The purpose of this exploratory study was to examine the influence of socialization and mentoring on minority students' academic and overall experiences in Master's degree level STEM programs at a large, Midwestern university. A sample was used of University of Nebraska-Lincoln Master's degree recipients who had completed the Master's Degree Graduate Studies Exit Survey and had identified themselves as being part of a science, technology, engineering or math (STEM) graduate program. Participants were then classified as a majority or minority group member based on their gender and racial or ethnic background. These groups were examined for mentoring and socialization experiences and how these correlated to their academic and overall experiences at the University of Nebraska-Lincoln. The following paragraphs describe the statistical results for each of the four hypotheses that examined the various elements of STEM Master's degree students' experiences.

Hypotheses

Four hypotheses were examined in this study and three different statistical analysis formulas were used. The independent samples *t* test was used in two hypotheses, which compared the group means of two groups using a continuous variable. Multiple regression analysis was used in one hypothesis to understand relationship between several independent or predictor variables and a dependent variable. Finally, a Pearson Correlation was used to determine the degree of the relationship between two variables. For calculations, the researcher used the p-value of $\leq .05$ to determine whether or not

results were statistically significant except in the case of the multiple regression analysis where a p-value of < .15 was used.

Each participant completed the Master's Degree Graduate Student Exit Survey distributed by the Graduate College to all Master's degree students post-graduation. For the purposes of this study, seven sections of the survey were utilized: Introduction, Overall Satisfaction, Faculty Mentoring and Advising, Level of Engagement/Preparation, Outcomes, Demographic Information, Ethnicity Information of US Citizens. Participants' subjective responses were evaluated by the researcher in four sections: Overall Satisfaction, Faculty Mentoring and Advising, Level of Engagement/Preparation, and Outcomes.

Hypothesis Examining Majority and Minority Academic Experience

The first hypothesis called for a comparison of majority and minority STEM Master's students rankings their academic experience at the university.

H_1: Master's degree students who are considered a minority in STEM fields rank their academic experience the same as students in the majority.

The following table (Table 3) presents the survey items used in this assessment and scale of measurement.

Table 3
Ranking Academic Experience Survey Item and Scale

Survey Item	Point Scale	Scale
Considering your most recent degree program at UNL, please rate each of the following: Your academic experience at this university	5	Poor to Excellent

Total Maximum in Ranking Academic Experience (H_1)	5

The researcher used a t-test to determine if there was a significant difference between majority and minority groups' rankings of academic experience at the university. For the group statistics, the number of respondents for each group (N), the mean score (M), and the standard deviation (SD) are displayed in Table 4. T-test results, listing the tscore (*t*), the degrees of freedom (*df*), and the significance at $p < .05$ are also summarized in Table 4 and illustrated in Figures I and II.

Table 4
Summary of Group Statistics and t-test Results for Ranking of Academic Experience for Majority and Minority Groups

	Group Statistics			t-test for Equality of Means		
	N	M	SD	*t*	*df*	*Sig. (2-tailed)*
Ranking of academic experience				-.26	124	.79
Majority	54	3.80	1.07			
Minority	72	3.85	1.10			

* $p < .05$

Figure I. Majority Academic Experience Ranking

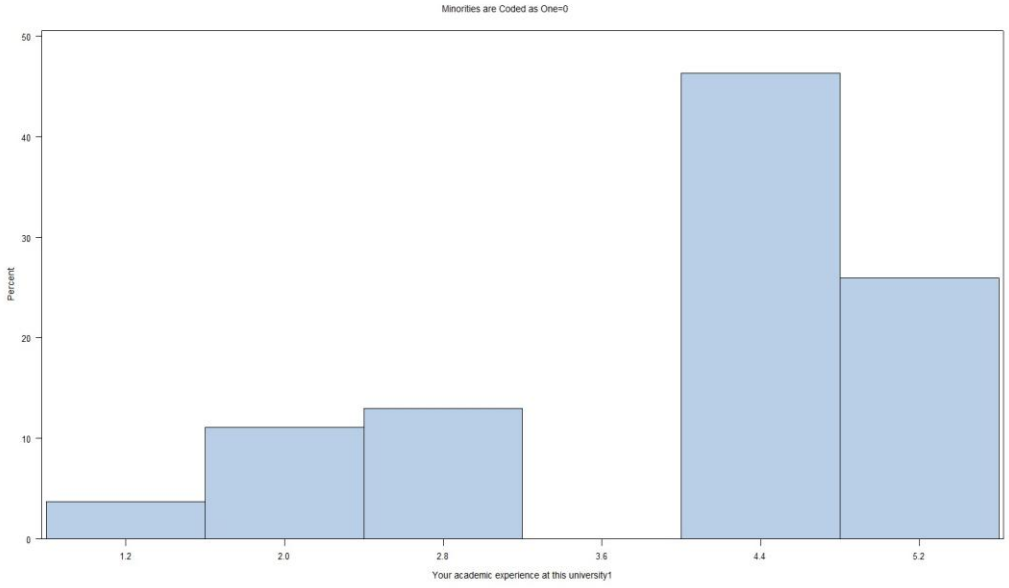
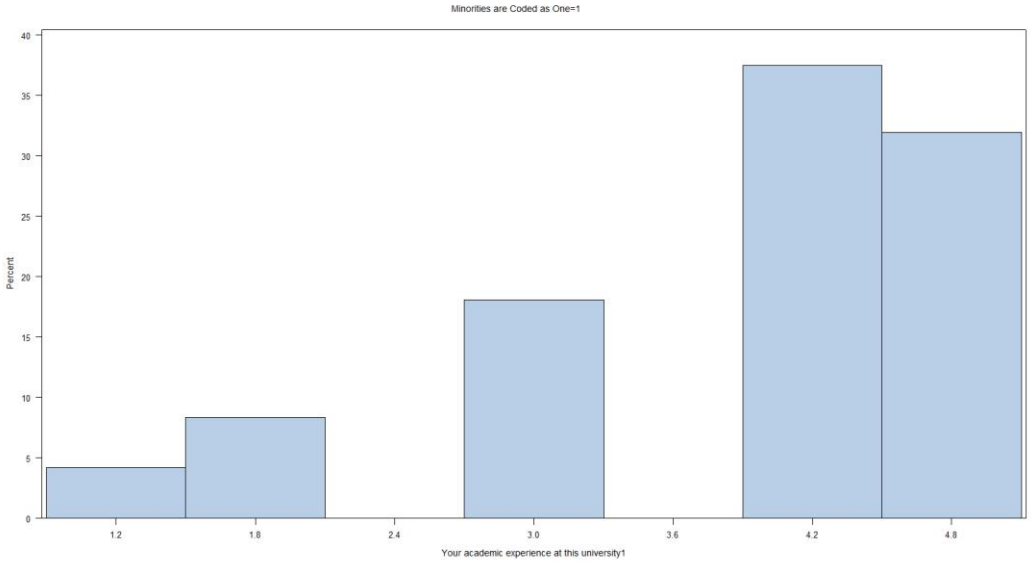


Figure II. Minority Academic Experience Ranking



The results presented in Table 4 and Figures I and II demonstrate there was no significant difference between the ranking of academic experience among the majority and minority groups in STEM Master's degree programs at this university ($df = 124$; $p = .79$). Therefore, the researcher failed to reject the null hypothesis. In summary, this data indicated that one could generally conclude that majority and minority Master's degree students in these STEM disciplines do not have significantly different academic experiences.

The next hypothesis examined the relationship between academic advising or mentoring and minority respondents' academic experience.

Hypothesis Examining Relationship Between Adviser and Academic Experience

The second hypothesis explored the relationship between the mentoring and advice a student received from an adviser in multiple areas of influence.

H_2: The advice received from an adviser by minority students in Master's level STEM programs does not relate to how they rank their academic experience.

This hypothesis examined which areas of an adviser's influence and mentoring were most related to the minority students' ranking of their academic experience at the University of Nebraska-Lincoln. The following table (Table 5) presents the survey items used in this assessment and scale of measurement.

Table 5
Minority Groups' Ranking of Faculty Mentoring and Advising

Survey Item	Point Scale	Scale
How helpful was the advice you received from your faculty advisor in each of these areas?		
Selection of a thesis topic	4	Not at all helpful to Very helpful
Your thesis research	4	Not at all helpful to Very helpful
Advice on writing and revising your thesis	4	Not at all helpful to Very helpful
How timely was the advice you received from your faculty advisor?		
Selection of thesis topic	4	Not at all timely to Very timely
Your thesis research	4	Not at all timely to Very timely
Advice on writing and revising your thesis	4	Not at all timely to Very timely
Total Maximum in Ranking Mentoring from Faculty Adviser	24	

The researcher used stepwise regression analysis to determine which, if any, of these items related to the minority groups' rankings of academic experience at the university. There were 46 responses to this question from the minority group population (N=46). These statistics are illustrated below in Table 6.

Table 6
Regression Analysis: Mentoring Influence on Minority Group's Ranking of Academic Experience

	R^2	*SE*	*Sig (one-tailed)*
Timeliness of advice in thesis topic selection	.47	.23	.03
Helpfulness of advice in thesis research	.51	.18	.07
Timeliness of advice in writing and revising one's thesis	. 54	.18	.11

*$p < .15$

The overall R^2 for this model was 0.54 and according to the data, three areas were positive predictors of academic experience. It was found that influence of an adviser in the areas timeliness of advice in thesis topic selection, helpfulness of advice in doing thesis research, and timeliness of advice in writing and revising one's thesis were statistically significant positive predictors of academic experience. Meaning 54 percent of the variance in academic experience can be explained by these three factors. In general, one could conclude there is a relationship between the mentoring and advising a minority Master's student in STEM receives and their ranking of academic experience. Therefore, the researcher rejected the null hypothesis.

The third hypothesis explored minority and majority socialization experiences in

Master's degree STEM programs.

Hypothesis Examining Majority and Minority Socialization

The next hypothesis examined the socialization experiences of the majority and minority populations.

H_3: Minority Master's degree students have the same socialization experiences as members of the majority.

The following table (Table 7) presents the survey items used in this assessment and scale of measurement.

Table 7
Socialization Experiences Survey Items and Scales

Survey Item	Point Scale	Scale
How many research presentations (including poster presentations did you make on your campus during your graduate studies (not including presentations given in class or in regularly scheduled not-for-credit lab meetings)?	6*	0 to unlimited
How many research presentations (including poster presentations) did you make at meetings away from your campus or university (regional, national or international)?	6*	0 to unlimited
Did you receive any funds for travel from your program for the presentation(s) you made away from campus?	2	Yes or No
Based on research	6*	0 to unlimited

conducted while you were a graduate student, how many articles or book chapters have you authored or co-authored that have been published or accepted for publication?		
How many others are currently under review?	6*	0 to unlimited
Overall, how well do you think your graduate program at UNL prepared you to:		
Identify issues and problems important to society from the perspective of your discipline	4	1 to 4
Speak, write and think like members of your academic discipline or profession	4	1 to 4
Demonstrate personal integrity in your academic and professional life	4	1 to 4
Obtain employment in your field of specialization	4	1 to 4
Total Maximum Score Possible for Socialization Experiences (H_3)	42	

*Point scale of 6 because that was the highest participant answer

The maximum and minimum scores assessing socialization experiences of the majority and minority groups are summarized in Table 8. The number of respondents for each group (N), the mean score (M), and the standard deviation (SD) are also displayed.

Table 8
Summary of Socialization Experiences

	N	M	SD	Minimum Score	Maximum Score
Majority	51	9.98	3.96	4	21
Minority	68	9.78	4.81	2	25

The group statistics for socialization were then used as a predictor for academic experience. These statistics, the number of respondents for each group (N), the mean score (M), and the standard deviation (SD) are displayed again in Table 9. The researcher used a t-test to determine if there was a significant difference between the majority and minority population's socialization experiences. The t-test results, listing of t-score (*t*), the degrees of freedom (*df*), and the significance ($p < .05$) are also summarized in Table 9 and illustrated in Figures III and IV.

Table 9
Summary of Group Statistics and t-test results for Majority and Minority Socialization

	Group Statistics			t-test for Equality of Means		
	N	M	SD	*t*	*df*	*Sig. (2-tailed)*
Socialization experiences as predictor of academic experience				0.24	119	0.88
Majority	51	9.98	3.97			
Minority	68	9.80	4.81			

*$p < .05$

The results presented in Table 9 demonstrated that, there was not a statistically significant difference in the socialization experiences of the majority and minority groups, $t(117) = .24$, $p > .05$. Therefore, the researcher failed to reject the null hypothesis. As a result, one could conclude that, in general, the majority and minority Master's degree STEM populations are receiving the same socialization experiences.

The final hypothesis examined the correlation between the minority group's

rankings of academic experience and overall experience.

Hypothesis Examining Minority Overall Experience

The fourth hypothesis explored the relationship between the minority group's ranking of academic experience and their ranking of overall experience.

H_4: Academic experience does not directly correlate to the overall experience of the minority student population in Master's degree level STEM programs.

This hypothesis called for an examination of the relationship between the minority group's rankings of academic experience and overall experience. Using a Pearson's Correlation to determine dependence of the two variables for the minority population as a whole, it was determined that $r = .835$ with $p < .05$. As $r = .835$, it can be determined that, in general, there is a strong correlation between academic experience and overall experience for minority students in Master's degree STEM programs at this university, and the higher the ranking of academic experience for minority students, the higher the ranking will be for overall experience. For this reason, the researcher rejected the null hypothesis.

Summary

The results of this study showed that based on the statistical evidence, the researcher rejected two hypotheses: 2 and 4. There were statistically significant differences found in relation to these hypotheses, which referred to the relationship between the minority students' mentoring or advising and their ranking of academic experience, and the relationship between the minority groups' ranking of academic experience and overall experience.

There was no statistical difference in the comparisons of the majority and

minority groups' experiences. It was found that majority and minority participants ranked their academic experiences statistically similar, and both groups of respondents experienced generally similar socialization opportunities. Although the researcher failed to reject these hypotheses (1 and 3), there could be a chance of Type II error in both cases. The results indicated the data in this study are inconsistent with previous literature on underrepresented minority STEM students. Further research should be done with this population in order to confirm or contradict these hypotheses.

In summary, significance was found in the influence of advising or mentoring on the minority population's ranking of academic experience. Additionally, this population was found to have a strong correlation between academic and overall experience. The implications of these findings, as well as the others, will be depicted in the next chapter.

In the following chapter, a discussion of the results is offered. A summary of the findings of this study, the implications of these findings, and suggestions for additional research are also included.

CHAPTER FIVE

SUMMARY AND DISCUSSION

The purpose of this exploratory study was to examine the influence of socialization and mentoring on minority students' academic and overall experiences in Master's degree level STEM programs at a large, Midwestern university. A sample was used of University of Nebraska-Lincoln Master's degree recipients who had completed the Master's Degree Graduate Studies Exit Survey and had identified themselves as being part of a science, technology, engineering or math (STEM) graduate program. Participants were then classified as a majority or minority group member based on their gender and racial or ethnic background. These groups were examined for mentoring and socialization experiences and how these correlated to their academic and overall experiences at the University of Nebraska-Lincoln. The results of this study found that minority and majority students ranked their academic and socialization experiences at the University of Nebraska-Lincoln statistically similar and minority academic experience is highly correlated with the overall experience at the university. Additionally, advise from an adviser in the areas of thesis topic selection were positive predictors of academic experience. In this chapter, the researcher will summarize the findings of the study, present general conclusions and implications, and make recommendations for future research.

Summary of Findings

Four hypotheses were examined in this study. The findings from the statistical analyses were summarized for each hypothesis and were reported in the following

statements.

Data Concerning Majority and Minority Academic Experiences

1. In general, the majority and minority groups ranked their academic experiences statistically similar. The mean ranking of academic experience for the majority group (n=54) was 3.78 with a standard deviation of 1.07 while the mean ranking for the minority group (n=72) was 3.85 with a 1.10 standard deviation and $t(124) = -.26$, $p > .05$. Therefore, there was no statistical significance between majority and minority groups ranking of academic experience at the university.

Data Concerning Mentoring and Adviser Advice as Predictor of Academic Experience

2. In general, three areas of mentoring were statistically significant predictors of academic experience: thesis topic selection (R^2=.47), helpfulness of advice in doing thesis research(R^2=.51), and timeliness of advice in writing and revising one's thesis (R^2=.54). The overall R^2 was .54, meaning 54% of variance in academic experience can be explained by these three factors.

Data Concerning Socialization Experiences

3. In general, collectively there was not a statistically significant difference in the socialization experiences of the majority and minority groups, $t(117) = .24$, $p > .05$. Using the sum of all the socialization experiences as a predictor of academic experience, the mean for the majority group (n=51) was 9.98, standard deviation of 3.96, while the minority group mean (n=68) was 9.78 and had a standard deviation of 4.81.

Data Concerning Minority Overall Experience

4. In general, minority respondents' academic experience was highly correlated to their overall experience ($r = .84$, $p < .05$), meaning the higher the respondent ranked their academic experience, the higher the ranking of their overall experience.

Discussion

The primary research question of this study was "Are the experiences of minority Master's degree students in STEM fields different than the experiences members of the majority group?" Prior research suggested that socialization and mentoring of minority students was vital to their experience at a university and was usually different from students who were classified as members of the majority. This study examined both groups' rankings of their academic experience and socialization experiences. It additionally explored the correlation of advice the minority group received from an adviser to academic experience and academic experience to overall experience of the minority group. The data showed that in the University of Nebraska-Lincoln Master's degree STEM programs minority and majority academic and socialization experiences were relatively similar, while adviser advice to minority participants was related to academic experience and academic experience was highly correlated to overall experience at the university. These findings will be discussed in further detail following.

The first research question was: *How do minority students rank their academic experience at this university as compared to the majority?* Data from the Master's Degree Graduate Studies Exit Survey showed there was not a statistically significant difference in the majority and minority groups' rankings of their academic experience.

Both groups of degree recipients ranked their academic experience between good and very good (3 and 4 on the Likert scale).

In analysis of the second question, *Does the advice received from an adviser influence the way minority students feel about their academic experience at this university,* the multiple regression statistical formula predicting academic experience showed that, for the minority group population, timeliness of advice in thesis topic selection, helpfulness of advice in doing thesis research, and timeliness of advice in writing and revising one's thesis were positive predictors of academic experience, while other factors related to adviser advice were not significant predictors.

The third research question was: *Are minority students receiving the same socialization experiences as students who are members of the majority and does that influence their academic experience?* It was found that socialization, as measured by a) the number of research presentations given on and off campus; b) the number of research articles published or under review; c) the participant's ranking of the preparedness they thought they received in identifying issues and problems important to society from the perspective of their discipline; and d) the participants ranking of how they thought their program did in preparing them to speak, write and think like other members in their field; was a good predictor or academic experience, and overall, majority and minority students are receiving the same socialization opportunities. This is inconsistent with previous research, which found that females (who make up a large portion of the minority population in this study) usually did not receiving the same socialization experiences as males (Herzig, 2004; Sallee, 2011).

The fourth and final research question posed was: *How does the academic experience of minority students correlate to their overall experience at this university?* In this study, both socialization and mentoring (i.e., adviser interaction) experiences were significantly related to academic experience. For the purpose of this question, academic experience was found to highly correlate with the minority participants' ranking of their overall experience at the University of Nebraska-Lincoln.

Implications and Recommendations for Future Research

The results of this study demonstrated an overall lack of significant difference in the experiences of Master's degree majority and minority groups in STEM at the University of Nebraska-Lincoln. The data in this study showed that regardless of gender or racial/ethnic background, the majority and minority groups ranked their academic and socialization experiences very similarly, contrary to the hypotheses made by the researcher. In all, from this data one may assume that STEM programs at the University of Nebraska-Lincoln are providing the same opportunities and experiences to all students, regardless of gender, race and ethnicity based on the measurements done in this study. However, previous research, while limited, implies this should not be the case in STEM programs. Therefore, additional research is needed to examine the other factors not included in this study that may influence academic experience at the University of Nebraska-Lincoln. Additionally, academic experience and socialization for majority and minority groups in STEM should be explored at other types of institutions, including private and smaller colleges or universities. These findings collectively may encourage and assist department administrators and personnel in implementing further assurances for all STEM graduate students.

As the researcher hypothesized, advice received from an adviser did relate to the minority participant's academic experience. This finding is consistent with the idea that mentoring is valuable and important to graduate students (Cooper, 2000; Herzig, 2002; Hollenshead et al., 1994; Etzkowitz et al., 2000 all cited in Herzig, 2004, p. 191; McGuir & Reger, 2003). The reinforcement from this study emphasizes the need for mentoring and good adviser/advisee relationships in STEM departments. As implemented by department personnel from this knowledge, formalized mentoring program or communication tracking of adviser/student contact could ensure these student needs are being met. However, further research should be done to determine what form of mentoring is needed in STEM programs and particularly for graduate students. Previous research has not yet examined how using prior experiences can influence future mentoring relationships and programs. This research should also be assessed specific to women, as racial/ethnic minority graduate students in STEM programs at the University of Nebraska-Lincoln are minimal. Best practices of peer institutions with similar research focuses should also be analyzed prior to program implementation within disciplines as well.

In this study the overall correlation of minority participants' academic experience to overall experience was high. Data showed that, overall, adviser advice and socialization both were good predictors of academic experience for these students. It can then be assumed that if academic experience (mentoring and socialization experiences included) was good, so then should overall experience However, prior research on the factors that influence graduate students' academic experience is not comprehensive enough to draw unequivocal conclusions. Therefore, as previously stated, additional

research examining these factors should be explored. It could also be assumed that retention could be effected by these experiences, however, further research on graduate student retention would need to be examined in the context of STEM fields in order to stretch these implications to that subject area. Based on the data in this study, University of Nebraska-Lincoln STEM departments could further develop opportunities for students to receive mentoring, publish or present their research, and become more intertwined in their academic or professional community, as these elements have been deemed influential in these programs.

Conclusion

Mentoring and socialization have an impact on the experiences of graduate students, and based on the findings of this study, that includes Master's degree students in STEM programs at the University of Nebraska-Lincoln. At this institution, it was found that all Master's level students, regardless of majority or minority group status, experienced similar socialization opportunities and overall academic experiences during the course of their graduate work. Based on this study, if this was a goal of the University of Nebraska-Lincoln Master's degree STEM programs, these disciplines could be deemed successful and should be encouraged by these findings. However, as these findings are not consistent with previous research, further investigation should be done to get an accurate assessment and comparison of these populations.

Through this exploratory study, it was also found that minority students' mentoring experiences could be directly related to their academic experience and their academic experience to their overall experience. If the mentoring and socialization of

these minority students is good, so then should their overall experience at the university follow suit.

In closing, while differences exist between all students' backgrounds and experiences, including those in this study, the researcher concludes that socialization and mentoring of Master's degree STEM students may shape academic and overall experiences and that at UNL—all STEM Master's students have equal opportunities to flourish in their program.

REFERENCES

Beoku-Betts, J. (2004). African Women Pursuing Graduate Studies in the Sciences: Racism, Gender Bias, and Third World Marginality. *NWSA Journal, 16*(1), 116-135. Retrieved from http://www.jstor.org/stable/4317037.

Bystydzienski, J.M. (2004). (Re)Gendering Science Fields: Transforming Academic Science and Engineering. *Feminist Formations, 16*(1), viii-xii.

Carnegie Foundation. (2010). *Carnegie Classifications: Institution Profile.* Retrieved from http://classifications.carnegiefoundation.org/lookup_listings/view_institution.php?unit_id=181464&start_page=standard.php&clq={%22sizeset2005_ids%22%3%2216%22}

Cole, D. & Espinoza, A. (2008). Examining the Academic Success of Latino Students in Science Technology Engineering and Mathematics (STEM) Majors. *Journal of College Student Development, 49*(4), 285-300. DOI: 10.1353/csd.0.0018

Davidson, M.N. & Foster-Johnson, L. (2001). Mentoring in the Preparation of Graduate Researchers of Color. *Review of Educational Research, 71*(4), 549-574. Retrieved from http://www.jstor.org/stable/3516098.

Gardner, S.K. & Barnes, B.J. (2007). Graduate Student Involvement: Socialization for the Professional Role. *Journal of College Student Development, 48*(4), 369-387. DOI:10.1353/csd.2007.0036.

Garforth, L. & Kerr, A. (2009). Women and Science: What's the Problem?. *Social Politics: International Studies in Gender, State and Society, 16*(3), 379-403.

Granados, R. & Lopez, J.M. (1999). Student-Run Support Organizations for Underrepresented Graduate Students: Goals, Creation, Implementation, and Assessment. *Peabody Journal of Education, 74*(2), 135-149. Retrieved from http://www.jstor.org/stable/1493081.

Hanson, S.L. (2004). African American Women in Science: Experiences from High School through the Post-Secondary Years and Beyond. *Feminist Formations, 16*(1), 96-115.

Herzig, A.H. (2004). Becoming Mathematicians: Women and Students of Color Choosing and Leaving Doctoral Mathematics. *Review of Educational Research, 74*(2), 171-214. Retrieved from http://www.jstor.org/stable/3516055.

Johnson-Bailey, J., Valentine, T., Cervero, R.M., & Bowles, T.A. (2009).Rooted in the Soil: The Social Experiences of Black1 Graduate Students at a Southern Research

University. *The Journal of Higher Education, 80*(2),178-203. DOI:10.1353/jhe.0.0040

Kirk, M. (2005). Life on the Frontlines: One Woman's Evolution from Warrior to Diplomat. *Feminist Formations, 17*(1), 45-57.

Kohlstedt, S.G. (2004). Sustaining Gains: Reflections on Women in Science and Technology in 20th-Century United States1. *Feminist Formations, 16*(1), 1-26.

Kuh, G. D. (2001). *The National Survey of Student Engagement: Conceptual framework and overview of psychometric properties.* Bloomington, IN: Indiana University Center for Postsecondary Research.

Maton, K.I., Hrabowski, F.A. III, & Schmitt, C.L. (2000). African-American college students excelling in the sciences: College and post-college outcomes in the Meyerhoff Scholars Program. *Journal of Research in Science Teaching*, 37, 629-654.

McGuire, G.M. and Reger, J. (2004). Feminist Co-Mentoring: A Model for Academic Professional Development. *NWSA Journal, 15*(1), 54-72. Retreived from http://www.jstor.org/stable/4316944.

Merrium-Webster Dictionary. (2011) As retrieved from http://www.merriam webster.com/dictionary/

National Center for Educational Statistics. (2011). Digest of Education Statistics. Retrieved from http://nces.ed.gov/programs/digest/2010menu_tables.asp.

National Science Foundation. (2011). NSF at a Glance. http://www.nsf.gov/about/glance.jsp

Palmer, R.T., Davis, R.J. &Thompson, T. (2010). Theory Meets Practice: HBCU Initiatives That Promote Academic Success Among African Americans in STEM. *Journal of College Student Development, 51*(4), 440-443. DOI:10.1353/csd.0.0146

Reddy, S. (25 March 2011). Latinos Fuel Growth in Decade. *The Wall Street Journal.* Retrieved from http://online.wsj.com/article/SB10001424052748704604704576220603247344790.html.

Rose, G.L. (2005). Group Differences in Graduate Students' Concepts of the Ideal Mentor. *Research in Higher Education, 46*(1), 53-80. Retrieved from http://www.jstor.org/stable/40197385.

Rosser, S.V. (2002). Twenty-Five Years of NWSA: Have We Built the Two-Way Streets Between Women's Studies and Women in Science and Technology?. *Feminist Formations, 14*(1), 103-123.

Rosser, S.V. (2004). Using POWRE to ADVANCE: Institutional Barriers Identified by Women Scientists and Engineers. *Feminist Formations, 16*(1), 50-78.

The Institution for Advanced Learning and Research. (2011). Education and Outreach: STEM Disciplines. Retrieved from https://www.ialr.org/education/life-long learning/419

Trower, C.A. & Chait, R.P. (2002). Faculty Diversity: Too little for too long. *Harvard Magazine.* Retrieved from http://harvardmagazine.com/2002/03/faculty-diversity.html

United States Census Bureau. (2011). Demographic Profiles. Retrieved from http://2010.census.gov/news/press-kits/demographic-profiles.html.

University of Nebraska-Lincoln. (2011, Sept. 1)*University of Nebraska-Lincoln 2011-2012 Fact Book.* Retrieved from http://irp.unl.edu/factbooks.html.

Valian, V. (2004) Beyond Gender Schemas: Improving the Advancement of Women in Academia. *Feminist Formations, 16*(1), 207-220

Van Maanen, J. and E. H. Schein (1979). "Toward of Theory of Organizational Socialization." Research in Organizational Behavior, 1: 209-264

APPENDICIES

APPENDIX A

Master's Degree Graduate Studies Exit Survey

Master's Degree Graduate Studies Exit Survey

Introduction

Congratulations on completing your master's degree! As a graduate of UNL, you are uniquely qualified to provide valuable information to help us evaluate and improve our graduate programs.

The following survey is designed to help us assess the effectiveness of your graduate program. It takes approximately 5 to 10 minutes to complete the survey. The information you provide is confidential; all responses are aggregated to ensure individual confidentiality. Please respond fully to each question.

Again, congratulations on your achievements. And thank you in advance for helping us understand the impact of graduate education.

Graduation Date

Please indicate the degree you completed.

You were primarily enrolled

- ○ Full-time
- ○ Part-time

Most of your coursework was completed:

- ○ On-campus
- ○ Off-campus (distance education)

Overall Satisfaction

Considering your most recent degree program at UNL, please rate each of the following:

	Excellent	Very Good	Good	Fair	Poor
Your academic experience at this university	○	○	○	○	○
Your student life experience at this university	○	○	○	○	○
Your overall experience at this university	○	○	○	○	○

Training program/program quality

Did your master's program provide you with an orientation to help you understand the process of completing your graduate degree?

- ○ Yes
- ○ No

Master's Degree Graduate Studies Exit Survey

Training program/program quality

How effective was this orientation in helping you to understand the process of completing your master's degree?

- ○ Very effective
- ○ Fairly effective
- ○ Neither effective nor ineffective
- ○ Ineffective

Training program/program quality

Were you provided with a written set of expectations about academic requirements and expected progress?

- ○ Yes
- ○ No

Other than course grades and results of written or oral examinations, did your program provide a formal assessment of your academic progress at least annually?

- ○ Yes
- ○ No

Support

Please rate the adequacy of support you were provided during your graduate education in the following areas:

	Excellent	Very Good	Good	Fair	Poor
Financial Support	☐	☐	☐	☐	☐
Computer Resources	☐	☐	☐	☐	☐
Your personal work space [e.g., desk or office]	☐	☐	☐	☐	☐
Library and electronic resources	☐	☐	☐	☐	☐
Laboratory, clinical or studio facilities	☐	☐	☐	☐	☐

Faculty Mentoring and Advising

Master's Degree Graduate Studies Exit Survey

Which master's degree option did you complete?

- ○ Option I (thesis)
- ○ Option II or III (non-thesis)

Faculty Mentoring and Advising

How helpful was the advice you received from your faculty advisor in each of these areas?

	Very Helpful	Somewhat Helpful	Not Very Helpful	Not At All Helpful	N/A
Selection of a thesis topic	○	○	○	○	○
Your thesis research	○	○	○	○	○
Advice on writing and revising your thesis	○	○	○	○	○
Selection of academic career options	○	○	○	○	○
Selection of nonacademic career options	○	○	○	○	○
Search for professional employment	○	○	○	○	○

How timely was the advice you received from your faculty advisor?

	Very Timely	Somewhat Timely	Not Very Timely	Not At All Timely	N/A
Selection of a thesis topic	○	○	○	○	○
Your thesis research	○	○	○	○	○
Advice on writing and revising your thesis	○	○	○	○	○
Selection of academic career options	○	○	○	○	○
Selection of nonacademic career options	○	○	○	○	○
Search for professional employment	○	○	○	○	○

Faculty Mentoring and Advising

How helpful was the advice you received from your faculty advisor in each of these areas?

	Very Helpful	Somewhat Helpful	Not Very Helpful	Not At All Helpful	N/A
Selection of academic career options	○	○	○	○	○
Selection of nonacademic career options	○	○	○	○	○
Search for professional employment	○	○	○	○	○

Master's Degree Graduate Studies Exit Survey

How timely was the advice you received from your faculty advisor?

	Very Timely	Somewhat Timely	Not Very Timely	Not At All Timely	N/A
Selection of academic career options	○	○	○	○	○
Selection of nonacademic career options	○	○	○	○	○
Search for professional employment	○	○	○	○	○

Professional Development

If you were a teaching assistant (TA) at any time during your graduate studies, how helpful was this experience with respect to your professional development?

- ○ Very helpful
- ○ Somewhat helpful
- ○ Not very helpful
- ○ Not at all helpful
- ○ N/A - never a TA

If you were a teaching assistant (TA), how helpful was the training you received for teaching?

- ○ Very helpful
- ○ Somewhat helpful
- ○ Not very helpful
- ○ Not at all helpful
- ○ N/A - never a TA

If you were a research assistant (RA) at any time during your graduate studies, how helpful was this experience with respect to your professional development?

- ○ Very helpful
- ○ Somewhat helpful
- ○ Not very helpful
- ○ Not at all helpful
- ○ N/A - never an RA

Level of Engagement/Preparation

Master's Degree Graduate Studies Exit Survey

How many research presentations (including poster presentations) did you make on your campus during your graduate studies (not including presentations given in class or in regularly scheduled not-for credit lab meetings)?

How many research presentations (including poster presentations) did you make at meetings away from your campus or university (regional, national or international)?

Level of Engagement/Preparation

Did you receive any funds for travel from your program for the presentation(s) you made away from campus?

- Yes
- No

Level of Engagement/Preparation

Based on research conducted while you were a graduate student, how many articles or book chapters have you authored or co-authored that have been published or accepted for publication?

How many others are currently under review?

Outcomes

Master's Degree Graduate Studies Exit Survey

Overall, how well do you think your graduate program at UNL prepared you to:

	Exceptional preparation	Good Preparation	Adequate Preparation	Inadequate Preparation	Not Applicable to My Graduate Program
Identify issues and problems important to society from the perspective of your discipline	○	○	○	○	○
Speak, write and think like members of your academic discipline or profession	○	○	○	○	○
Conduct independent, innovative research	○	○	○	○	○
Teach effectively about your discipline	○	○	○	○	○
Communicate effectively about your discipline with non-specialists	○	○	○	○	○
Demonstrate personal integrity in your academic and professional life	○	○	○	○	○
Obtain employment in your field of specialization	○	○	○	○	○
Work collaboratively with diverse groups from other disciplines	○	○	○	○	○
Contribute to the broader needs of society	○	○	○	○	○

Career Plans

What is your primary immediate post-graduate plan

Have you secured a position as indicated in the above question?

- ○ Yes
- ○ No

If you were to start your graduate program again, would you select:

	Yes	No
The same university	○	○
The same graduate department	○	○
The same field of specialization	○	○
The same graduate advisor	○	○

Demographic Information

Master's Degree Graduate Studies Exit Survey

Gender:

- Male
- Female

Are you a US citizen?

- Yes
- No

Ethnicity information of US citizens

Which best describes your ethnic background?

- Hispanic or Latino
- Not Hispanic or Latino
- Prefer not to respond

Which best describes your racial background?

- American Indian or Alaska Native
- Asian
- Black or African American
- Native Hawaiian or Other Pacific Islander
- White
- Prefer not to respond

Additional Comments

Help us understand your perceptions of your graduate experience at UNL.

APPENDIX B

Permission to Use Data Collected from Survey

Re: Grad Student Exit Survey data

Laurie H Bellows to: Maggie Jobes

History: This message has been replied to.

Sure, Maggie. I have no problem with you using the Exit survey data.

* * * * * * * * * * * * * * *
Laurie Bellows, Ph.D.
Assistant Dean
Professor of Practice
Office of Graduate Studies
University of Nebraska-Lincoln
1100 Seaton Hall
Lincoln, NE 68588-0619
402/472-9764
lbellows1@unl.edu
http://www.unl.edu/gradstudies

From: Maggie Jobes/GRAD/UNL/UNEBR
To: Laurie H Bellows/GRAD/UNL/UNEBR@University of Nebraska
Date: 01/11/2012 02:31 PM
Subject: Grad Student Exit Survey data

Laurie,

I just wanted to double check with you and make sure it was still ok for me to use the Masters Graduate Student Exit Survey data for my thesis. I want to look at how the experiences of the majority (white males) compare to that of the minority (women and students of color) in the STEM fields. Literature points to the importance of mentoring and socialization within the discipline, and I think there are some questions in there that could give me the data to support this.

I know Renee had talked to you about this and you and I had talked about it briefly last summer but I wanted to double check before I proceed!

Thanks so much!

Maggie Jobes

Recruitment Graduate Assistant
Office of Graduate Studies
University of Nebraska-Lincoln
1100 Seaton Hall
Lincoln, NE 68588-0619
(402) 472-5845
mjobes@unlnotes.unl.edu

APPENDIX C

IRB Approval

University of Nebraska Lincoln

February 1, 2012 Maggie Jobes Department of Educational Administration 4721 Old Cheney Rd #9 Lincoln, NE 68516 Miles Bryant Department of Educational Administration 133 TEAC, UNL, 68588-0360 IRB Number: 20120112409 EX Project ID: 12409 Project Title: Thesis: Master's degree students in graduate STEM programs: The influence of the experience Dear Maggie: This letter is to officially notify you of the approval of your project by the Institutional Review Board (IRB) for the Protection of Human Subjects. It is the Board's opinion that you have provided adequate safeguards for the rights and welfare of the participants in this study based on the information provided. Your proposal is in compliance with this institution's Federal Wide Assurance 00002258 and the DHHS Regulations for the Protection of Human Subjects (45 CFR 46) and has been classified as exempt. You are authorized to implement this study as of the Date of Final Approval: 02/01/2012. We wish to remind you that the principal investigator is responsible for reporting to this Board any of the following events within 48 hours of the event: * Any serious event (including on-site and off-site adverse events, injuries, side effects, deaths, or other problems) which in the opinion of the local investigator was unanticipated, involved risk to subjects or others, and was possibly related to the research procedures; * Any serious accidental or unintentional change to the IRB-approved protocol that involves risk or has the potential to recur; * Any publication in the literature, safety monitoring report, interim result or other finding that indicates an unexpected change to the risk/benefit ratio of the research; * Any breach in confidentiality or compromise in data privacy related to the subject or others; or * Any complaint of a subject that indicates an unanticipated risk or that cannot be resolved by the research staff. This project should be conducted in full accordance with all applicable sections of the IRB Guidelines and you should notify the IRB immediately of any proposed changes that may affect the exempt status of your research project. You should report any unanticipated problems involving risks to the participants or others to the Board. If you have any questions, please contact the

Becky R. Freeman

IRB office at 472-6965. Sincerely, Becky R. Freeman, CIP for the IRB

Full Accreditation