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Female Ph.D. Completion: How Field of Study Moderates the Predictive Relationships Between Social and Academic Interactions With Faculty, Research Productivity and Degree Completion

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FEMALE PH.D. COMPLETION: HOW FIELD OF STUDY MODERATES

THE PREDICTIVE RELATIONSHIPS BETWEEN SOCIAL AND ACADEMIC

INTERACTIONS WITH FACULTY, RESEARCH PRODUCTIVITY

AND DEGREE COMPLETION

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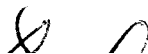M.A. April 2002, Waseda University, Tokyo, Japan

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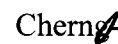
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ABSTRACT

FEMALE PH.D. COMPLETION: HOW FIELD OF STUDY MODERATES THE PREDICTIVE RELATIONSHIPS BETWEEN SOCIAL AND ACADEMIC INTERACTIONS WITH FACULTY, RESEARCH PRODUCTIVITY AND DEGREE COMPLETION

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Old Dominion University, 2010
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The purpose of this study was to seek further understanding of how field of study moderated the predictive relationships between social interactions with faculty, academic interactions with faculty, research productivity, and female Ph.D. students' degree completion. A survey was conducted to collect data on the participants' degree completion, satisfaction with social and academic interactions with faculty, research productivity as well as their field of study. The sample included 412 female former Ph.D. students in various fields at a large, public research university in the mid-Atlantic region who were enrolled between 1993 and 2004.

Logistic regression analyses were conducted to see if (1) field of study moderated the predictive relationships between social and academic interactions with faculty, research productivity and degree completion, and if (2) social and academic interactions with faculty and research productivity had predictive utility on degree completion. The results indicated that (1) field of study had no moderator effect on the predictive relationships between social and academic interactions with faculty, research productivity, and degree completion, and (2) none of the predictor variables predicted degree completion.

Members of the Advisory Committee: Dr. Danica Hays
Dr. Cherng-Jyh Yen

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There is a sign in front of my desk that says "You only fail if you quit trying". This is a quote from Edgar Cayce's reading. It has taken me almost eight years to complete my doctorate, and this quote encouraged me time and time again when I needed perseverance. Completion of this dissertation would not have been possible without the help of the following individuals that I owe a great debt of gratitude.

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CHAPTER 1

INTRODUCTION

The Council of Graduate Schools published its first book in their major national

demonstration project on Ph.D. completion and attrition in 2008. In this book, doctoral

education is called "the jewel in the crown", yet, the reality of doctoral education

presented in the study was alarming. National data suggest that only 56.6 % of doctoral

students complete their degrees within 10 years, varying widely by fields. Ten-year

completion rates range from about 63% for Engineering and Life Sciences to

approximately 49% for Humanities (Council of Graduate Schools, 2008, p. 63).

Female 10-year cumulative completion rates are 55%, which is lower than men's

10-year cumulative completion rates of 58%, and the difference is statistically significant

(Council of Graduate Schools, 2008). When disaggregated by field, the difference is

even greater; 10-year cumulative completion rates for males in the Science, Technology,

Engineering and Mathematics (STEM) fields are 62%, but only 54% of female students

in those fields complete their Ph.D.s in 10 years (Council of Graduate Schools, 2008).

Moreover, women take longer to complete their doctoral degrees. Research shows that

25% of women who complete their doctoral degrees within 10 years do so after year

seven, compared with 18% of men (Council of Graduate Schools, 2008). Nettles and

Millett (2006) found that in their survey sample of approximately 10,000 doctoral

students, the mean elapsed time to degree was 5.97 years. Engineering students who

completed their doctorates averaged the time to degree at 5.23 years, and humanities

students completed their degrees in 7.41 years. Nettles and Millett also found that

women who completed their doctorates nearly half a year longer (6.25 years) on average than their male counterparts (5.75 years).

Gender disparity in academic labor supply has been primarily discussed in two domains: recruitment and attrition of female Ph.D. students as well as faculty members. Women make up about half of the doctoral student body today. The increase in the number of female doctoral students has been dramatic. In 1971, the proportion of women in doctoral programs was only 14%, and today, it is 46% (Council of Graduate Schools, 2008; England et al., 2007). In some fields of study, such as Educational Administration, Communications, Sociology, and Psychology, there are more women than men. The United States has succeeded in reducing gender disparity in undergraduate higher education (U.S. Department of Education, 2008); however, in doctoral education, the disparity still remains. Today, more than half of the bachelor's degree recipients are women, while at the doctoral level, female representation in Ph.D. recipients is only about 36% (Bowen & Rudenstine, 1992).

Women are more likely to drop out of graduate school during their master's program (Bowen & Rudenstine), and their underrepresentation in Science, Technology, Engineering and Mathematics (STEM) is still a national concern (Herzig, 2004; Kulis, Sicotte & Collins, 2002; Valian, 2005; Xu, 2008). This concern is represented by the lower enrollment and completion rates of female Ph.D. students as well as lower representation of female faculty in these fields. For example, only 29% of the entering doctoral students into STEM fields and only 6.6% of faculty in Physics departments are women (Council of Graduate Schools, 2008; Nelson, 2004).

Two models explain gender disparity in academia; one is the pipeline model and the other is the deficit model. The pipeline model emphasizes the importance of increasing the volume of flow of female students and preventing leakage (attrition) (Xu, 2008). The deficit model uses the social, cultural, and political obstacles to explain limited opportunities presented to female scholars (Settles, Cortina, Malley & Stewart, 2006; Xu). While the pipeline model fails to explain why there is "leakage" in the pipeline and how to prevent it, the deficit model looks at the individual experiences that directly hinder the success of females in academia.

Researchers show that the academic environment is often perceived as non-accommodating and sometimes hostile toward women (Lovitts, 2001; Margolis & Romero, 1998). In academic environments where female representation in leadership or faculty positions is scarce, support is limited for issues that impact women, such as child bearing and rearing (Ulku-Steiner, Kurts-Costes, & Kinlaw, 2000). Moreover, some women in male-dominated fields experience subtle discrimination in the workplace, classrooms, or laboratories (Pedrioli, 2004). Studies show that male and female doctoral students have distinctly different graduate school experiences; "women in male-dominated programs report lower self-concepts than other students" and "have more negative views of their competencies throughout their doctoral studies" (Ulku-Steiner et al., pp. 304-305).

Nettles and Millett (2006) revealed for doctoral education in the United States that men rated their satisfaction toward student-faculty social interactions higher than women, and women in Engineering, Sciences and Mathematics have lower research productivity than men, after background and experience factors are adjusted. Reasons for these issues

were not provided. Madden and Carli (1981) found that students who are more satisfied with their programs achieved higher persistence rates. There is a growing body of literature that focuses on the student experiences in American graduate schools (Ellis, 2001). These studies suggest that satisfaction is related to interactions with faculty (Madden & Carli) and there is greater gender disparity regarding student-faculty interactions as well as satisfaction in STEM fields (Ehrenberg & Kuh, 2009).

The theoretical framework for understanding doctoral completion rests on Tinto's socialization and integration theory (Gardner, 2008; Golde, 2000; Tinto, 1993; Turner & Thompson, 1993). Simply put, the more the student is socialized and integrated into the program environment, the more likely the student is to persist. Tinto described this process in two parallel systems: academic integration and social integration. Lovitts (2001) elaborated and extended Tinto's framework, and concluded that academic integration has a greater impact on doctoral persistence than social integration, because academic integration is indeed the purpose of graduate education, and social integration is the consequence of interactions that takes place in the process of achieving academic integration.

Academic integration refers to the process in which Ph.D. students gain both skills and attitudes appropriate for academic work such as time-management skills, and skills in reading, writing, note taking, preparing papers, critical thinking, and studying for exams (Hossler, Bean & Associates, 1990). Pascarella (1980) emphasized that the informal contact students experience with faculty members enhances academic integration and reduces attrition. Tinto (1993) further acknowledged that acquisition of

knowledge and the development of academic competencies deemed necessary for doctoral research are important for successful doctoral completion.

Tinto (1993) also described the social experience within the local communities of the department. Peer and faculty play a more important role in the development and determination of academic competencies than is the case generally at the undergraduate level. Other researchers used the framework of socialization as an important factor in doctoral students' performance, satisfaction, and success (see Gardner, 2008; Gardner & Barnes, 2007; Golde, 2000; Nettles & Millett, 2006; Turner & Thompson, 1993).

Socialization in graduate school refers to the process through which individuals gain the knowledge, skills, and values necessary for successful entry into a professional career (Weidman, Twale & Stein, 2001). One of the most current models of socialization, as presented by Weidman, Twale and Stein, characterizes the socialization of graduate students as a dynamic nonlinear process in which a student acquires the knowledge of general role expectations (through mass media and interactions with others), becomes invested in the role (by enrolling in school and rejecting alternatives), becomes involved (by interacting with others), and identifies with stereotypical dimensions of the role. A major part of the socialization process of graduate students is interactions with others in between and among the various constituent elements (Weidman, Twale & Stein). In particular, socialization "entails a continuing interaction between the individual and those who seek to influence him" (Clausen, 1968, p. 3).

Fields of study, in the sense of academic disciplines such as STEM (Science, Technology, Engineering and Mathematics) and non-STEM, have their own cultures, codes of conduct, values, and qualities that influence the experiences of the students

(Becher, 1981; Nettles & Millett, 2006). Fields of study variances in female Ph.D. student experiences are well documented (Gardner, 2008; Golde, 2005; Golde & Dore, 2004; Nettles & Millett; Uklu-Steiner, Kurtz-Costes & Kinlaw, 2000). For example, Gardner studied socialization experience of doctoral students in chemistry and history, both of which are disciplines with predominantly male students enrolled, and found that the female students faced gender issues and sexist attitudes. Berg and Ferber (1983) also reported that the women who entered the physical and biological sciences were less fortunate in having come to know at least one male faculty member quite well or in having been treated as a junior colleague by at least one male faculty member. As graduate experiences can vary by gender according to fields of study, one must look to particular disciplines or fields of study "to better understand and isolate the phenomenon, understanding that field of study has its own culture, values, and attitudes that influence those working within it" (Gardner & Barnes, 2007, p. 371).

Studies show that female Ph.D. students achieve less research productivity than men (Nettles & Millett, 2006; Wong & Sanders, 1983). There are claims that research productivity during doctoral study has great importance in degree completion. Maher, Ford, and Thompson (2004) reported notable differences in the degree of research experiences among early- and late- female Ph.D. completers. The study found that late degree completing women had problems identifying dissertation topics and encountered significant obstacles in collecting and analyzing data. Wong and Sanders maintained that research productivity at the time of graduation is among the most important dimensions of graduate training. Nettles and Millett found that research productivity is an important predictor of doctoral degree completion across all fields. Research productivity is also

associated with successful professional development and socialization in respective fields of study (Nettles & Millett).

Disciplinary and institutional contexts play a critical role in graduate students' socialization and experiences (Austin, 2002; Hopwood, McAlpine & Harris-Huemmert, 2008). In a study of underrepresentation of female faculty in STEM fields, Xu (2008) found that women's stronger turnover intentions are highly correlated with dissatisfaction with negative experiences in the academic environment, and described an academic culture that provides women with fewer opportunities, limited support, and inequity in leadership. As noted above, female Ph.D. students have distinctively different experiences than male Ph.D. students, especially when they are in fields dominated by males. Female Ph.D. students' different experiences in respective fields are related to their socialization efforts and research productivity (Nettles & Millett, 2006).

STATEMENT OF THE PROBLEM

Ph.D. completion needs to be studied in greater detail because attrition of Ph.D. students is a great loss for the persons involved, the higher education institutions, and society as a whole. Lovitts (2001) reported that students described their departure of a doctoral program as personally devastating, leaving them depressed and even sometimes suicidal. In addition, the cost to the institution of not retaining a doctoral student is significant when taking into account the number of hours faculty and staff spend on the student as well as the financial assistance provided. As a result, the institution gains no return on its prior investment when a Ph.D. student leaves without completing the degree. Not only is it costly to the institution, but attrition of Ph.D. students is costly to society,

because "society needs highly educated people from all disciplines to fill a wide variety of positions both inside and outside the academy" (Lovitts, p. 4).

Given the ongoing concerns about the underrepresentation of females in academe (Herzig, 2004; Kulis, Sicotte & Collins, 2002; Nelson, 2004; Settles, Cortina, Malley & Stewart, 2006; Valian, 2005; Wilson, 2004; Xu, 2008), it is imperative that graduate schools produce more female Ph.D.s who can serve as role models. Nelson points out that it is likely that a female Ph.D. student in Engineering and Sciences will earn a degree without having access to a woman faculty member in her field. Female Ph.D. attrition has been attributed in part to the lack of faculty mentors of the same sex (Berg & Ferber, 1983; Kurtz-Costes, Helmke & Uklu-Steiner, 2006), and female students' experience in the program has been characterized by isolation and marginalization (Nelson; Herzig, 2004).

There is enough evidence that there is a notable gender disparity in socialization experiences by disciplines (Gardner, 2008; Golde, 2005; Golde & Dore, 2004) as well as research productivity (Nettles & Millett, 2006; Wong & Sanders, 1983). What is not reported is the predictability of these differences in degree completion. Moreover, most studies that report gender disparity in academe, especially in STEM fields, focus on the recruitment and attrition of female faculty members and not the doctoral students (see Clark & Concoran, 1986; Kulis, Sicotte & Collins, 2002; Valian, 2005). The main premise of these studies is to show how much accumulated disadvantage female scholars have in academe. When underrepresentation of females and the female labor supply in academe are discussed, female Ph.D. completion must be considered in greater detail because that is where the labor supply is created. A study is needed that focuses on the

experiences of female Ph.D. students as related to the predictability of those experiences on their degree completion, as well as the moderator effect of field of study.

PURPOSE OF THE STUDY

The purpose of this study was to seek further understanding of how field of study moderated the predictive relationships between social interactions with faculty, academic interactions with faculty, research productivity, and female Ph.D. students' degree completion.

This study focused on interactions with faculty, as faculty-student relationship has a reported influence on female Ph.D. degree progress (Maher, Ford & Thompson, 2004), students' overall research productivity, self-concept, and professional commitment (Weiss, 1981). This study sought to understand the predictive relationships between female Ph.D. students' interactions with faculty, research productivity, and degree completion.

Predictive relationships between female doctoral students' interactions with faculty, research productivity, and their degree completion may be different from discipline to discipline (Becher, 1981). With the assumption that the nature of interactions between female students and faculty may inherently be different between disciplines that are predominantly male and predominantly female, this study sought to deepen the understanding of how field of study (STEM and non-STEM) may moderate the predictive relationships between female doctoral students' degree completion, their interactions with faculty, and research productivity.

RESEARCH QUESTIONS

The following questions were tested:

1. Does field of study moderate the predictive relationship between social

    interactions with faculty and female Ph.D. students' degree completion?

    1-1.   If field of study moderates the predictive relationship between

           social interactions with faculty and female Ph.D. students' degree

           completion, then do social interactions with faculty predict female

           Ph.D. students' degree completion in respective fields of study?

    1-2.   If field of study does not moderate the predictive relationship

           between social interactions with faculty and female Ph.D. students'

           degree completion, then do social interactions with faculty predict

           female Ph.D. students' degree completion?

2. Does field of study moderate the predictive relationship between academic

    interactions with faculty and female Ph.D. students' degree completion?

    2-1.   If field of study moderates the predictive relationship between

           academic interactions with faculty and female Ph.D. students'

           degree completion, then do academic interactions with faculty

           predict female Ph.D. students' degree completion in respective

           fields of study?

    2-2.   If field of study does not moderate the predictive relationship

           between academic interactions with faculty and female Ph.D.

           students' degree completion, then do academic interactions with

           faculty predict female Ph.D. students' degree completion?

3. Does field of study moderate the predictive relationship between research productivity and female Ph.D. students' degree completion?

    3-1.   If field of study moderates the predictive relationship between research productivity and female Ph.D. students' degree completion, then does research productivity predict female Ph.D. students' degree completion in respective fields of study?

    3-2.   If field of study does not moderate the predictive relationship between research productivity and female Ph.D. students' degree completion, then does research productivity predict female Ph.D. students' degree completion?

DEFINITION OF KEY TERMS

Definitions of key terms used in this study are listed below.

<u>Social integration</u>: students' finding social niches in which they share values and support each other through friendship and mutual concern for the other's well-being (Hossler, Bean & Associates, 1990).

<u>Academic integration</u>: the skills and attitude appropriate for academic work that include integrity, delayed gratification, valuing scholarship, time management skills, skills in reading, writing, note taking, preparing papers, critical thinking, and studying for exams (Hossler, Bean & Associates, 1990).

<u>Social interactions with faculty</u>: students' perceptions of the relationships that develop between students and faculty outside of classrooms, such as quality and frequency, as well as student satisfaction about, casual conversations with, the faculty outside of class and social functions involving both faculty and students.

Academic interactions with faculty: students' perceptions on all aspects related to the quality of instruction: faculty availability to meet with students, faculty academic advising, faculty feedback on projects and academic progress, faculty interest in student research, the quality of professional advising, and job placement by faculty.

Research productivity: student participation in research activities since enrollment in the Ph.D. program. Activities include publication of books, book chapters and articles in refereed and non-refereed journals and conference presentations.

Field of study: This study will distinguish fields of study in two major categories, STEM (Science, Technology, Engineering, and Mathematics) and non-STEM (all other fields including Humanities and Education) at the doctoral level.

SIGNIFICANCE OF THE STUDY

By exploring predictive relationships between social and academic interactions with faculty and research productivity on female Ph.D. degree completion and moderator effects of field of study on these predictive relationships, this study can assist higher education institutions in implementing effective programs to help female Ph.D. students succeed. Information regarding the effects of student-faculty interactions can be used by faculty and deans for the purpose of promoting more effective interaction patterns between students and faculty which have a critical impact on degree completion. Academic and research departments can use the results of the study to promote research productivity with doctoral students because of its impact on degree completion. Academic departments can also utilize the findings regarding field of study differences in degree completion for planning purposes such as hiring new faculty and promoting a new welcoming atmosphere for minority and female students.

This study may also provide useful information that can be used to promote more effective graduate enrollment management. By identifying the predictive nature of the student-faculty interactions, research productivity as well as the field of study variances, institutional graduate enrollment managers will be able to make more sound decisions and develop strategic plans regarding recruitment and retention as well as matriculation of female Ph.D. students.

LIMITATIONS OF THE STUDY

The results of this study were constrained by the specificity of the sample utilized, posing a threat to the external validity of the study. Results of this study should be carefully considered for application in other settings.

Tinto (1993) proposed a longitudinal model of doctoral persistence, in which the process of doctoral degree attainment is divided into three major and distinct stages that are linked and built on each other: (1) transition and adjustment, (2) candidacy and development of competence, and (3) completing the research project. Due to constraints of time and sample availability, longitudinal design was impractical, and a retrospective approach was chosen. Because of this limitation in research design, this study did not address how successful or unsuccessful completion of one stage affected the completion of the next stage, or how time spent in the program influenced the nature of student-faculty interactions and the outcomes of research productivity.

Another limitation of this study, which is related to the previous point, was that this study did not address the possibility that student-faculty interactions as well as research productivity in each stage of the students' degree progress could have a different predictability on degree completion. For example, this study was not intended to answer

a question such as "do students who have more research productivity early in their program have a greater chance of completing the degree?" Because the participants were asked about their experiences 6 to 17 years ago, it was difficult to differentiate when the interactions occurred or when they were productive. Therefore this study focused on the students' satisfaction with their interactions with faculty or research productivity during all stages of the program which includes coursework, candidacy, and dissertation completion.

SUMMARY

Since the 1970s, female representation in doctoral education has steadily increased. Today almost half of the doctoral student body consists of women, whereas the number was only 14% in 1971 (England et al., 2007; Council of Graduate Schools, 2008). Despite the drastic increase in the number of female students enrolled in Ph.D. programs, gender inequality still exists in degree completion rates and time to degree. Ph.D. completion has been explained largely by the integration and socialization theories. Departmental cultures sometimes contribute to the distinct differences in program experiences among female and male students. This study aimed to deepen the understandings of female student experiences in Ph.D. programs in terms of interactions with faculty, research productivity, and fields of study with a hope that it would enhance existing literature about female Ph.D. completion and strategies for success.

CHAPTER 2

REVIEW OF THE LITERATURE

This study examined how field of study moderates the predictive relationships between social interactions with faculty, academic interactions with faculty, students' research productivity, and female Ph.D. students' degree completion. This chapter provides the theoretical framework of Ph.D. completion that is used for this study.

INDIVIDUAL STUDENT FACTORS THAT INFLUENCE PH.D. COMPLETION

Approximately half the students who enter doctoral programs leave without completing their degrees (Council of Graduate Schools, 2008). Researchers have tried to pinpoint the factors that influence Ph.D. completion to improve the completion rates and to alleviate personal, institutional, and social loss caused by Ph.D. attrition (Ehrenberg, Jakubson, Groen, So & Price, 2008; Hoskins & Goldberg, 2005; Malone, Nelson & Nelson, 2004; Smith, Maroney, Nelson, Abel & Abel, 2006). The factors that influence degree completion include the student selection process, program structure, advising, program flexibility, relationships with significant others, family responsibilities, support systems, employment responsibilities, financial strains, and time constraints, among many others (Smith, et al.).

The findings of several studies suggest that no single variable explains doctoral student completion or non-completion (Bair & Haworth, 1999, Hoskins & Goldberg; Malone et al.). For example, an extensive and in-depth study about doctoral student attrition by Lovitts (2001) concluded that a combination of many factors, such as accessibility to faculty, acceptable research topics, ability of the dissertation committee

chair to secure grants, relationships with significant others, employment demands, time constraints, and family issues affect a student's decision to complete a doctoral program.

Bair and Haworth (1999) synthesized findings from 118 research studies on doctoral completion and non-completion conducted between 1970 and 1998. Their findings indicated that (a) attrition and persistence rates vary widely by field of study and even more widely by program of study; (b) departmental culture affects doctoral student persistence; (c) difficulties with the dissertation relate to attrition; (d) academic achievement indicators, with the exception of graduate record examination scores, are not effective predictors of degree completion; (e) employment and financial factors are poor indicators of persistence; and (f) retention rates vary widely among institutions.

Most graduate programs have responded to the problem of low Ph.D. completion rates by placing greater emphasis on the selection process, hoping that if they did a better job of making better admission decisions by selecting the students who are more likely to complete, then completion rates would go up (Bowen & Rudenstine, 1992; Lovitts 2001). Much of the current literature places particular emphasis on the impact of individual characteristics and abilities of the students on degree completion (Bowen & Rudenstine, 1992; McDermott, 2002; Tinto, 1993). For example, McDermott studied three factors that included (a) the students' locus of control; (b) behavior patterns; and (c) their perceptions of critical stress to predict degree completion of an Ed.D. program. The study found that all three factors were statistically significant predictors of doctoral completion.

Lovitts (2001) pointed out that the emphasis on student characteristics rather than organizational culture of graduate school and the structure and process of graduate

education has been ineffective and counterproductive, and claimed that "universities cannot learn about the true causes of student discontent and cannot take proper remediative actions" (p. 37). Lovitts argued that "it is not the background characteristics students bring with them to the university that affect their persistence outcomes; it is what happens after they arrive" (p. 2). Bair and Haworth (1999) also argued that personal factors such as academic achievement indicators and employment status do not serve as good indicators of Ph.D. persistence. Both Lovitts and Bair and Haworth agree that the factors that influence Ph.D. completion and non-completion are "deeply embedded in the organizational culture of the graduate school and the structure and process of graduate education" (Lovitts, p. 2).

SOCIALIZATION OF DOCTORAL STUDENTS

Socialization has been shown to be a critical factor in doctoral student success and degree completion (Gardner, 2008; Gardner & Barnes, 2007; Turner & Thompson, 1993). It is the process "in which a newcomer is made a member of a community" (Golde, 1998, p. 56). From the perspective of the group, it is a mechanism through which new members learn the values, norms, knowledge, beliefs, the interpersonal and other skills that facilitate role performance. From the individual's perspective, it is a process of learning to participate in social life (Clark & Concoran, 1986). Golde (1998) claimed that the socialization of graduate students is an unusual process, where new students are simultaneously socialized into the role of graduate student, and given preparatory socialization into a profession. Golde (1998) defined that doctoral students' socialization involves four tasks: intellectual mastery, learning about the realities of life as a graduate

student, learning about the profession for which one is preparing, and integrating oneself into the department.

The role of the organization as a function of doctoral student socialization is especially important. Margolis and Romero (1998) analyzed the organizational culture of a Sociology department of a graduate school, and concluded that the departmental culture that is "very male, very White, very old, and very conservative" (p. 1) is being reproduced by the hidden curriculum, cultural messages embedded in departmental norms and practices, and reinforced through socialization and professionalization. Similarly, in an effort to understand the ways in which the department and discipline, as made visible in the departmental culture and practices, influence doctoral attrition, Golde (2005) conducted interviews and observations at four departments with 58 students who left their doctoral programs. Golde suggested that cultural messages (e.g., what kinds of jobs are acceptable and what the life of faculty members entails) impact students' integration and desire to be integrated into both the department and the broader discipline.

Margolis and Romero (1998) as well as Golde (2005) emphasized the role of the department as an entity that disseminates the cultural messages that affect the completion or non-completion of Ph.D. students. Golde stated, "Students are taught to think and act like scholars by watching faculty, conducting research on their own, attending professional meetings, and the like" (p. 200). Cultural messages are informal codes and expectations shared among the people in the department. They are embedded in the departmental policies and reward structures, as well as discourses and nonverbal communications. Golde claimed that the department determines the policies that affect student life, such as admissions, financial support, the requirements for degree

completion, and the curriculum, without being aware of how much they influence the students.

ACADEMIC AND SOCIAL INTEGRATION

Tinto (1993) advanced a theoretical model of student persistence for doctoral students using an undergraduate model of student departure. The core of his model is academic and social integration. Academic integration refers to the skills and attitudes appropriate for academic work that include integrity, delayed gratification, valuing scholarship, time management skills, skills in reading, writing, note taking, preparing papers, critical thinking, and studying for exams (Hossler, Bean & Associates, 1990). Social integration refers to students' finding social niches in which they share values and support each other through friendship and mutual concern for the other's well-being (Hossler et al.). Tinto (1993) suggested that at the doctoral level, social integration is more closely tied to academic integration than it is at the undergraduate level. He stated:

> Social membership within one's program becomes part and parcel of academic membership, and social interaction with one's peers and faculty becomes not only to one's intellectual development, but also to the development of important skills required for doctoral completion. In a very real sense, the local community becomes the primary educational community for one's graduate career. (p. 232)

Tinto (1993) used the term 'integration' synonymously with 'membership' gained through socialization. Successful academic and social integration means successfully socializing and becoming a member of the academic and social community of the graduate school, and successful socialization process is critical for a successful graduate career (Turner & Thompson, 1993).

FEMALE PH.D. STUDENTS' PROGRAM EXPERIENCE

Socialization theory has been particularly useful in understanding gender

differences in the academic environment (Anderson & Swazey, 1998; Corcoran & Clark,

1986; Golde, 1998; Turner & Thompson, 1993). In the ASHE-ERIC Higher Education

Report, Weidman, Twale, and Stein (2001) designed a conceptual framework for

understanding the socialization of graduate students and stated that when there is a

disjunctive situation in which new students are not accepted by faculty because they are

not like their predecessors (such as females in predominantly male programs), "pressures

toward divestiture of orientations perceived to be undesirable may be very strong" (pp. 8-

9).

Gardner (2008) interviewed 40 doctoral students in the disciplines of chemistry

and history at two research-extensive institutions to understand the effects of the

socialization process upon doctoral student success and retention in respective disciplines.

The study described female students' experiences in doctoral education and concluded

that female students and faculty do not fit the mold and feel displaced. She contended

that the lack of congruence between female students and departmental culture makes

them question their place in the academy in the present and in the future. The study also

revealed that female students in both disciplines experienced gender-related issues that

affected their experiences, a phenomenon explained by the fact that faculty in both

disciplines is still predominantly male-oriented and male-governed.

Maher, Ford, and Thompson (2004) conducted a survey with 160 female Ph.D.

completers and categorized them into early-finishers and late-finishers, in order to

identify factors that facilitate or constrain female doctoral students' degree progress.

Their study revealed that commitment to timely degree completion, the working relationship with faculty, funding opportunities, family issues, research experiences, and capacity to make the system work for them are factors that are associated with female students' degree progress.

Herzig (2004) studied female doctoral students in Mathematics, and emphasized that academic and social integration are critical to persistence, and that integration develops through particular types of participation in the communities of practice of graduate schools. More specifically, participating and becoming integrated in the research community increases the likelihood of persistence.

SOCIAL INTERACTIONS WITH FACULTY

Social interactions with faculty refer to the general relationships that develop between students and faculty outside of classrooms, such as the quality and frequency, as well as student satisfaction about, casual conversations with the faculty outside of class and social functions involving both faculty and students. Hoskins and Goldberg (2005) conducted in-depth interviews with 33 students in 17 different doctoral programs to identify factors that influenced students' decisions to persist or leave their counselor education doctoral programs. They found that faculty relationships that nurture the social-personal component of the student-program match were essential in the decision to persist in the program. The study suggested that an open, honest, and ongoing discussion between students and faculty members about student experiences, expectations, and goals can have a positive influence on students' persistence.

Weiss (1981) studied aspects of the socialization process in graduate and professional schools using data from a random subsample (N=8,476) of the 32,963

graduate students who completed the questionnaires for the Carnegie Commission National Survey of Higher Education between 1969 and 1970. The study measured the frequency of informal contact (such as meals or parties) with faculty or other graduate students from once a year or less to once a week or more. The study found that frequency and nature of contact with faculty members are significantly related to the level of professional role commitment and research productivity, whereas contact with other graduate students does not affect a student's level of professional role commitment. While 31% of the students who met informally with professors once a week or more were highly productive in terms of research activities such as journal publications and conference presentations, only 10% of the students, who met informally with faculty members once a year or less, were highly productive. Similarly, 37% of those with weekly contact with faculty have a high self-concept, compared to 14% with virtually no informal contact with professors.

ACADEMIC INTERACTIONS WITH FACULTY

Academic interactions with faculty refer to all the aspects related to the quality of faculty instruction: faculty availability to meet with students, faculty academic advising, faculty feedback on projects and academic progress, faculty interest in student research, the quality of professional advising, and job placement by faculty (Nettles & Millett, 2006). Academic interactions with faculty have been differentiated from social interactions with faculty in order to understand the true nature of faculty-student interactions necessary for doctoral student persistence and completion. A number of studies suggest the importance of mentorship in doctoral student success; however, they do not successfully describe the kind of interactions exchanged between the student and

the faculty mentor that are conducive to doctoral student success (Davis, 2007; Kurtz-Costes, Helmke & Uklu-Steiner, 2006).

Academic interactions with faculty often promote academic integration, and the study by Ehrenberg, Jakubson, Groen, So and Price (2007) confirms this point - having programs with better advising and having a program with requirements that are clear reduces attrition probabilities. Kurtz-Costes, Helmke and Ulku-Steiiner (2006) reported the importance of having interactions with supportive faculty mentors in students' academic experiences.

RESEARCH PRODUCTIVITY

Research productivity refers to research activities of Ph.D. students while they are pursuing their degrees. Such activities include conference presentations, journal articles and book chapters as well as book publications. Nettles and Millett (2006) found research productivity to be an important predictor of doctoral degree completion in all fields. For example, the study demonstrated that students in sciences and mathematics with research productivity were 3.9 times more likely to complete their doctorates than those without. Furthermore, they also found that students with high research productivity were more likely to have mentors, which is another indicator of doctoral student success.

Research productivity is an area that has not been extensively researched, although understanding the relationship between research productivity and doctoral degree completion has many policy and practical implications. Mahler, Ford, and Thompson (2004) compared early- and late- finishing female doctoral students and found that late-finishers reported they had faced difficulty pursuing their dissertation research. For example, late-finishers reported problems in identifying dissertation topics as well as

collecting or analyzing the data. Although no direct link has been suggested for early finishers, having fewer issues in dissertation research as a result of having more research experience in the program, and having more opportunities to conduct research and publish often, should provide students with options to choose a dissertation topic more easily as well as experience in data collection and analysis.

FIELD OF STUDY

Field of study refers to the academic disciplines. According to Becher (1981), disciplines are cultural phenomena. Becher stated that disciplines are "embodied in collections of like-minded people, each with their own codes of conduct, sets of values, and distinctive intellectual tasks" (p. 109). For example, sociologists are seen as highly politicized, very left, friendly, and interesting; whereas physicists are known as introverted, paranoic, defensive, narrow-minded, technocratic, and conservative.

Lovitts (2001) pointed out that the departments differ in culture, socialization processes, academic rigor, and dissertation and degree requirements. Nettles and Millett (2006) confirmed that field of study constitutes an area of diversity that defines the quality of doctoral students' experiences and performance, as well as challenges. Zhao, Golde, and McCormick (2007) studied factors affecting doctoral students' satisfaction with the advising relationship, and found that disciplinary differences exist in choice criteria and advisor behavior, and those were identified as more robust predictors of satisfaction than individual characteristics. Herzig (2004), who synthesized previous research on attrition and persistence of female and African American students of both genders in mathematics doctoral programs, noted that the common practice in many mathematics departments of isolating students from authentic mathematics practice limits

the types of relationships they are likely to develop with faculty. The assumption that the field of study affects the type of interaction with faculty requires further investigation.

Although there are many factors associated with Ph.D. students' degree completion and attrition, no study has ever focused on female program experience in terms of social and academic interactions with faculty and the extent to which field of study and research productivity, along with the socialization factors (academic and social interactions with faculty) have on the likelihood of degree completion of female students.

SUMMARY AND CONCLUSION

This review of the literature highlighted the critical aspects of understanding female doctoral completion. First, although past research has identified factors that influence Ph.D. degree completion, no one factor is responsible for explaining the completion of doctoral students. Second, current studies provide a heavy focus on the abilities and the characteristics of the students rather than the role external attributes play, such as program environment and nature of student-faculty relationships. Third, compared to the undergraduate model of student persistence and degree completion, doctoral student persistence and degree completion have distinctly different features, namely the fact that organizational culture of the discipline plays a critical role in students' overall experience.

Another critical factor highlighted in the research includes, relationship with program faculty, both social and academic, impacts the students' likelihood of degree completion (Golde, 2005; Lovitts, 2001; Maher, Ford & Thompson, 2004). Departmental cultures, as often embodied by program faculty, also have a significant impact on student experiences in the program, and they differ largely by discipline (Bair & Haworth;

Golde). Furthermore, Nettles and Millett (2006) noted there is a disturbing reality that female students have significantly lower research productivity than male students while they are in Ph.D. programs.

Rather than focusing on students' characteristics, which is done by so many current studies, this study attempted to establish an understanding of the relationship between female doctoral students regarding their program experiences and degree completion. This study used the framework of socialization theory, a process by which a student gains the understanding of the norms and values of the departmental and disciplinary culture. Successful socialization is considered to bring about successful academic and social integration that are key ingredients of student persistence and completion.

CHAPTER 3

METHODOLOGY

The purpose of this study was to seek further understanding of whether or not field of study moderated the predictive relationships between social interactions with faculty, academic interactions with faculty, research productivity, and female Ph.D. students' degree completion. The site of this study was a large, public research university in the Mid-Atlantic region with undergraduate enrollment of 14,000 and graduate enrollment of 6,500 at the time of data collection.

This study focused on the students' satisfaction with their interactions with faculty, as the faculty-student relationship has a reported influence on female Ph.D. degree progress (Maher, Ford & Thompson, 2004), overall research productivity, self-concept, and professional commitment (Weiss, 1981). This study also examined the extent to which research productivity predicted female doctoral degree completion, since female students are less productive during doctoral education compared to men, and it is found to be an important predictor of doctoral degree completion across all fields (Nettles & Millett, 2006).

Predictive relationships between female doctoral students' interactions with faculty, research productivity, and their degree completion may be different from discipline to discipline (Becher, 1981). With the assumption that the nature of interactions between female students and faculty may inherently be different across disciplines that are predominantly male and predominantly female, this study sought to deepen the understanding of how field of study moderated the predictive relationships

between female doctoral students' degree completion and their interactions with faculty and research productivity.

RESEARCH QUESTIONS

The following questions were tested:

1. Does field of study moderate the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion?

    1-1. If field of study moderates the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion, then do social interactions with faculty predict female Ph.D. students' degree completion in respective fields of study?

    1-2. If field of study does not moderate the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion, then do social interactions with faculty predict female Ph.D. students' degree completion?

2. Does field of study moderate the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion?

    2-1. If field of study moderates the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion, then do academic interactions with faculty predict female Ph.D. students' degree completion in respective fields of study?

    2-2. If field of study does not moderate the predictive relationship between academic interactions with faculty and female Ph.D.

students' degree completion, then do academic interactions with

faculty predict female Ph.D. students' degree completion?

3. Does field of study moderate the predictive relationship between research

productivity and female Ph.D. students' degree completion?

    3-1.   If field of study moderates the predictive relationship between

research productivity and female Ph.D. students' degree

completion, then does research productivity predict female Ph.D.

students' degree completion in respective fields of study?

    3-2.   If field of study does not moderate the predictive relationship

between research productivity and female Ph.D. students' degree

completion, then does research productivity predict female Ph.D.

students' degree completion?

To describe the methods employed in this study, first, a description of the research

population is presented, followed by an explanation of how participants of this study

were selected. Second, instruments used to measure both independent and dependent

variables are described along with a description of validity and reliability data whenever

possible. Finally, a description of procedures that were used in this study is presented as

well as an explanation of how data were analyzed.

RESEARCH PARTICIPANTS

The sample for this study was all female Ph.D. students (N=421) who enrolled at

a large, public research university in the mid-Atlantic region between 1993 and 2004.

The reason for not including students who enrolled after year 2004 was that the outcome

variable, which was degree completion or non-completion at the time of data collection

(2010), would not be adequately obtained for those students who began their program

after 2004, because the median time to degree is identified as approximately 6 years

(Nettles & Millett, 2006). Therefore in order to give adequate time for those who entered

the Ph.D. program, the last cohort that was included in the study was 2004. This study

focused on the experiences of female students who were in various Ph.D. programs.

Professional doctoral programs such as Doctor of Physical Therapy (DPT) and

Psychology Doctor (Psy. D.) were excluded from the study, as the nature and the degree

procedures of the program are fundamentally different from Doctors of Philosophy,

which share common degree components: coursework, candidacy, and dissertation.

Students' current contact information in the form of e-mail address or physical

address was obtained from the alumni office of the university used in this study. For

those students whose current e-mail addresses were not available, postcards were sent to

the students' current addresses (Appendix D). It encouraged the students to send an e-

mail to the researcher's e-mail address so that an invitation e-mail could be sent. The

post card also included the URL of the online survey, so that if they preferred not to send

an e-mail, they had an option to go directly to the survey. Once the students' current e-

mail addresses were identified, an invitation e-mail was sent, which solicited students to

participate in the Survey of Doctoral Student Experiences. Participation in this study was

therefore voluntary; however, in order to enhance the response rate of the survey, the

participants were notified that there would be a drawing for two gift certificates ($50

each) for which they could enter when they completed the survey.

The site of this study was a public, research university in the Mid-Atlantic region with undergraduate enrollment of 14,000 and graduate enrollment of 6,500 at the time of data collection. According to the *University Catalogue* of 1996-1998, undergraduate enrollment in 1996 was approximately 14,000, and graduate enrollment at that time was 3,000, suggesting a substantial expansion in the graduate student body. In the 1990s, the university offered Ph.D. programs in International Studies, Business Administration, Engineering and Sciences, as well as multidisciplinary Urban Studies Doctorate programs with concentrations in Health Services, Urban Education, and Urban Management. The university currently offers 70 bachelor's degrees, 60 Master's, and 35 doctoral degrees in various fields.

The university is located in a major maritime, military, and commerce center, and therefore has placed a strong emphasis on science, engineering, and technology, especially in maritime and aerospace sciences. It also has a long history of serving military personnel through its ROTC program. In addition, a new convocation center and new residence halls, as well as retail shops and a hotel have been built as part of the university's shift from being a commuter university to a residential university.

INSTRUMENT

Survey of Doctoral Student Experiences was developed based on Nettles and Millets' (2006) Survey of Doctoral Students' Finances, Experiences, and Achievements. The Survey of Doctoral Students' Finances, Experiences, and Achievements includes more than eight hundred variables, and it produced several indexes including student-faculty social interactions index and academic interactions with faculty index which consisted of answers to certain questions in the survey. Original questions were modified

slightly in order to consistently ask the participants their "satisfaction", as some of the questions were intended to ask "perceptions" rather than "satisfaction". For example, the question, "It is easy to develop personal relationships with faculty members in this program" was changed to ask the participants to rate their satisfaction with "The quality of personal relationships developed with faculty members in the program". The internal consistency scores for the original indexes, before modification, were .916 for the social interactions with faculty index and .853 for the academic interactions with faculty index.

The Survey of Doctoral Student Experiences contained indexes for student-faculty social interactions, student-faculty academic interactions, research productivity, as well as questions to collect demographic information such as ethnicity, citizenship, relationship status, and current income. The survey also collected academic information about the participants such as enrollment status, completion/non-completion, name of college/program and years attended, whether or not she took a leave of absence, and reason for stopping if she had left the program. The indexes in this survey have not been validated in any other study other than the original.

The survey included the following areas:

1. Student-faculty social interactions: five items (A-1, 2, 3, 4, and 5) rated on a satisfaction scale of 5 (very satisfied) to 1 (very dissatisfied). Questions included statements such as "I was satisfied with the quality of personal relationships with faculty members in the program" and "I was satisfied with the contact between professors and students in the program outside the classroom" (Nettles & Millett, 2006, p. 243). These items required respondents to rate their satisfaction with the experiences on a scale of "very

satisfied," "satisfied," "neither satisfied or dissatisfied," "dissatisfied," and "very dissatisfied." Responses were scored for each question, and a total score for these 5 responses for each participant were used as the student-faculty social interactions index in data analysis.

2. Satisfaction with student-faculty academic interactions: six items (A- 6, 7, 8, 9, 10, and 11) rated on a scale of 5 (very satisfied) to 1 (very dissatisfied). Questions included statements such as "I was satisfied with the quality of faculty instruction," and "I was satisfied with the availability of the faculty to meet with students." The 5-point Likert-type items asked the students their experiences with faculty in the academic setting while they were in the program. Respondents were asked to rate their satisfaction with student-faculty academic interactions on a scale of "very satisfied," "satisfied," "neither satisfied or dissatisfied," "dissatisfied," and "very dissatisfied." Responses were scored for each question, and a total score for all 6 responses for each participant were used as the student-faculty academic interactions index in data analysis.

3. Research Productivity: four items (A-12, 13, 14, and 15) asking the number of times the respondent had participated in research activities during the course of her doctoral program. The questions required respondents to indicate how many times she had participated in research activities such as "published an article in a journal" or "presented a paper at a conference". Responses were scored for each question, and a total score for all 4 responses for each participant were used in data analysis.

4. Field of Study: two items (A-20 and 21) asked which college the respondent attended and to specify the name of the program in which she enrolled. The university has 6 colleges, and the respondents were grouped into one of the two categories (STEM or non-STEM) based on which college she was enrolled. Engineering, Sciences and Health Sciences students were grouped into the STEM category, and Arts and Letters, Business, and Education students were grouped into the non-STEM category.

5. Completion or non-completion: One question (A-27) asked the respondent whether or not she has completed the degree.

6. Demographic questions include gender (to ensure that the study included females only), ethnicity, number of dependents, relationship status, citizenship status, whether or not she had taken a leave of absence from the program, and current gross income.

Internal consistency estimate of reliability of test scores was calculated for the above two indexes (satisfaction with student-faculty social interactions index and satisfaction with student-faculty academic interactions index). Cronbach's alpha for the social interactions index was .939 (.928 in pilot study) and for the academic interactions index was .903 (.782 in pilot study), indicating the errors due to content sampling are small enough and the indexes can be confidently used to monitor satisfaction with interactions with faculty both in social and academic contexts (Howard, Schmeck & Bray, 1979).

CONCEPTUAL AND OPERATIONAL DEFINITIONS OF RESEARCH VARIABLES

The predictor variables used in this study included: student-faculty social interactions, student-faculty academic interactions, research productivity, and field of study as a moderator variable.

Student-faculty social interactions are the students' satisfaction with the quality and the frequency of general, non-academic interactions with the faculty inside and outside of the classrooms. Student-faculty social interaction is a continuous variable measured by the index created based on questions from the Survey of Doctoral Student Finances, Experiences, and Achievements by Nettles and Millett (2006).

Student-faculty academic interactions are related to the students' satisfaction of the quality of faculty academic advising, faculty feedback on projects and academic progress, faculty interest in student research and the quality of professional advising, and job placement by faculty (Nettles &b Millett, 2006). Academic interactions with faculty were a continuous variable measured by the index created based on questions from the Survey of Doctoral Student Finances, Experiences, and Achievements by Nettles and Millett (2006).

Both student-faculty social and academic interactions with faculty were measured on the basis of their perceived 'satisfaction' with the interactions with faculty in both social and academic contexts. Since it is impossible to measure the objective quantitative and qualitative nature of student-faculty interactions from the past, this study chose to utilize the 'satisfaction' measure. Both are continuous variables and the total scores for each construct were used for data analyses.

Research productivity refers to the students' participation in research activities such as presentation of a paper, publication of a chapter, article, or a book while she was in the Ph.D. program. For each of the four areas, participants were asked to state the number of times they participated in those activities during the course of their program. It is a continuous variable and the total scores were used for data analyses.

Fields of study included two major categories, STEM (Science, Technology, Engineering, and Mathematics) and non-STEM (all other fields including Humanities and Education). It is a dichotomous variable coded 1 if the respondent was in the STEM fields, and coded 0 otherwise.

Completion of degree was a dichotomous, dependent variable coded 1 if the respondent completed the degree in which she had enrolled at the time of data collection (year 2010), and coded 0 otherwise.

PROCEDURE

PILOT STUDY

The Doctoral Student Institutional Experience Survey was first submitted to approximately 10 current Ph.D. female students in the College of Education and also 10 students in the College of Engineering at the research site (See Appendices A, B, and C). After the survey was conducted, the participants were asked to give feedback on the survey, and comment on the understandability and relevance of the questions, the appropriateness of the indexes, and whether or not any question was loaded or reflected known-answer-responses. This was intended to ensure face validity - that the questions were asked and understood as intended. Internal consistency of the two indexes used in

the analyses (satisfaction with social and academic interactions with the faculty) was assessed by computing the Cronbach's alpha.

Overall understandability, relevance, and appropriateness of the questions were assessed by questions such as: "I clearly understand the survey items;" "There are no places of the survey that causes me confusion;" "The questions offer all possible response options;" "None of the terminology is too difficult;" "The response options are mutually exclusive (to make it easier to select among them)";"The survey assumes an inappropriately low level of knowledge, and it drags on too slowly for me (response revered)". The mean scores for the above questions in the pilot survey ranged from 3.05 to 4.11 on a scale of 1 to 5, suggesting that the survey was well rated for its understandability, relevance, and appropriateness. There were, however, some comments that led to minor changes to the original survey. For example, instead of "married" for an answer option that asked the relationship status, the phrase "long-term committed relationship" was inserted, so the answer option was changed to "married or in a long-term committed relationship".

After the pilot study was conducted and questions and format were improved, e-mails containing the link to the online survey were sent to the current e-mail addresses of the former students who were enrolled in Ph.D. programs at the research site between 1993 and 2004 (see Appendix D). For those students whose e-mail addresses were not available, post cards were sent with the e-mail address of the researcher and a link to the online survey (see Appendix E). The online survey was opened on January 15, 2010, and a follow-up e-mail was sent two weeks after the initial e-mail was sent (see Appendix G). The survey was closed on February 22, 2010.

ANALYSES OF DATA

Preliminary Analyses:

First, descriptive analyses were conducted to provide general statistics of the

independent and dependent variables. Means, standard deviations, and ranges of scores

were calculated in order to obtain a clear view of the raw data as well as to detect any

data collection abnormality.

Statistical Analyses: Logistic Regression Analyses

Data were analyzed via binary logistic regression, which is the variant of

regression most appropriate for the properties collected in this study. Binary logistic

regression was chosen because it is the preferred statistic with the dependent variable

being a non-metric dichotomous criterion variable (degree completion or non-

completion), and the predictor variables being metric (indexes of social and academic

interactions with faculty and research productivity), unlike the traditional linear

regression analysis, where the criterion variable is a continuous variable and is assumed

to be normally distributed (Jaccard, 2001; Meyers, Gamst & Guarino, 2006; Peng & So,

2002). Logistic analyses for binary outcomes attempt to model the odds of an event's

occurrence and to estimate the effects of predictor variables on these odds, in such a way

that the probability that an event occurs and the probability that the event does not occur

are compared with a quotient (O'Connel, 2006). It is called the *logit* of *Y*, written as *logit*

(*Y*), and the equation for the relationship between the criterion variable and the predictor

variable can be described as follows:

$$Logit\ (Y) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k\ \text{(Menard, 2002)}.$$

One of the most important objectives of logistic regression is to obtain the odds ratio, which is a way of comparing whether the probability of a certain event is the same for two groups (Meyers, Gamst, & Guarino, 2006). Odds ratio of 1 implies that the event is equally likely in both groups, and an odds ratio greater than 1 indicates that the likelihood of an event happening is more likely in the group coded 1 than in the group coded 0 (Meyers et al.).

Although logistic regression and linear regression are analogous, because the criterion variable in logistic regression is dichotomous, using the least square technique to calculate the prediction is inappropriate for two reasons: first, equal variance assumption is violated, and second, the least squares method can produce predicted values greater than 1 and less than 0, values that are theoretically inadmissible (Meyers, Gamst, & Guarino, 2006). Instead of least squares, logistic regression uses maximum likelihood procedures to obtain the coefficient estimates (Pampel, 2000). Maximum likelihood estimation (MLE) seeks to maximize the log likelihood, which reflects how likely it is (the odds) that the observed values of the predictor variable(s) predict the criterion variable, and involves (1) computing the logistic regression equation and (2) interpreting the *logit* outcome (Meyers et al.).

This study analyzed moderator effects in logistic regression. A moderator effect is said to exist when the effect of a predictor variable on a criterion variable differs depending on the value of a third variable, commonly called a "moderator" variable (Jaccard, 2001). In this study, there was a possibility that the predictive relationships between social and academic interactions with faculty, research productivity, and female students' degree completion of a Ph.D. program might differ for students in the STEM

fields and non-STEM fields. In this case, completion or non-completion was the outcome or criterion variable, social and academic interactions with faculty as well as research productivity were the predictor variables, and field of study was the moderator variable.

The statistical significance of the moderator effect can be determined by examining the significance test of the logistic coefficient associated with the single product term; if the logistic coefficient for the product term is statistically significant, then it implies that the moderator effect is statistically significant (Jaccard, 2001). For a moderative logistic model with a quantitative/continuous predictor, X, a qualitative predictor, Z, and a product term, XZ, for the case of dummy coding on Z, the exponent of the logistic coefficient for X is the multiplicative factor by which the predicted odds change given a 1-unit increase in X for the reference group on Z. If, for example, student-faculty social interactions have the same effect for both STEM and non-STEM fields of study, (i.e., if there is no moderator effect), then the multiplying factor should be the same in both groups. Because field of study was a categorical variable, it was represented by two dummy variables, D_{stem} and $D_{non-stem}$. Product terms were generated between each of these dummy variables and student-faculty social interactions, and a logistic regression were performed using D_{stem}, $D_{non-stem}$, student-faculty social interactions, D_{stem} * student-faculty social interactions and $D_{non-stem}$ * student-faculty social interactions as predictors.

In order to determine the moderator effect of a moderator variable (field of study), the -2 log likelihood, also known as the deviation, was measured in two iterations of logistic regressions. The first block included only the two predictor variables, social

interactions with faculty, academic interactions with faculty, or research productivity and field of study. In the second block, a product term, which is created by multiplying the two variables by one another as predictor variables (Jaccard, 2001) was entered. The observed values for -2 log likelihood in two blocks were then compared, and the difference was checked against the critical values of chi square with degree of freedom being 1 (number of additional parameters into the second block). If there was a statistically significant decrease in the -2 log likelihood value, then it means that the model fit is statistically different from 0 (rejection of the null hypothesis). It can be interpreted that the product term increased the model fit, and it indicates the moderator effect of the moderator variable. On the other hand, if the inclusion of the product term does not lead to significant improvement of the model fit, then the null hypothesis is not rejected and the moderator effect is not observed.

In order to determine the predictive utilities of social interactions with faculty, academic interactions with faculty as well as research productivity on degree completion, a logistic regression analysis was performed on degree completion (1= completed and 0 = not completed) and perceived student-faculty social interactions, academic interactions and research productivity. For each predictor, logistic coefficients, exponents of the coefficients, 95% confidence intervals for the exponents, and p values were generated. The likelihood ratio significance tests were performed to evaluate whether or not the set of the predictor variables improves prediction of the dependent variable better than chance (Meyers, Gamst & Guarino, 2006). The likelihood significance tests are considered to be more reliable than the Wald significance test, and they are computed by

performing a logistic regression with each parameter omitted from the model and comparing the log likelihood model with and without the parameter (DTREG, 2009).

If the moderator variable showed a statistically significant effect, then the moderator variable was considered and the moderator effect was to be reported. If the moderator variable did not show a statistically significant effect, then the moderator variable would not be considered. The same procedure would be repeated for the other two predictor variables.

LIMITATIONS

The predictor variables in this study, student-faculty social interactions, student-faculty academic interactions, and research productivity are all based on the responses to the questions in the survey. In other words, these measures are self-reports of the respondents' perceptions and satisfactions of their perceived experiences of the past. This poses a limitation to this study, that these variables are only subjective and qualitative in nature.

The survey used for this study is an extraction from Nettles and Millet's (2006) Survey of Doctoral Students' Finances, Experiences, and Achievements. Since no other study has validated the original survey, the indexes used in this study faced validity limitations. Although the pilot study was conducted to minimize threats to face validity, threats to content validity, concurrent validity and construct validity could not be avoided.

Finally, as this study was conducted at only one institution, external validity is threatened, hence generalizability is limited. The results of this study must be carefully considered for application in other settings.

SUMMARY

This study examined the female Ph.D. students' experiences in the programs such as social interactions with the faculty, academic interactions with the faculty, and research productivity. The Survey of Doctoral Student Experiences was distributed to all female Ph.D. students who were enrolled in a research university in the mid-Atlantic region between 1993 and 2004 in order to collect data on their experiences while in the program. Logistic regression was performed to determine if there were predictive relationships between degree completion and social and academic interactions with faculty and research productivity, and the moderator effect of field of study on these predictive relationships was examined.

Results of this study will enhance the understanding of female doctoral students' experiences according to the disciplines in relation to their degree completion. This enhanced knowledge may help higher education institutions to implement measures that promote the successful completion of female doctoral students in various fields. If replicated in various types of institutions, the external validity will be improved, and generalizability will be enhanced.

CHAPTER 4

RESULTS

REVIEW OF THE STUDY

The purpose of this study was to seek further understanding of how field of study moderated the predictive relationships between social interactions with faculty, academic interactions with faculty, research productivity, and female Ph.D. students' degree completion. The research questions were:

1. Does field of study moderate the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion?

   1-1 If field of study moderates the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion, then do social interactions with faculty predict female Ph.D. students' degree completion in respective fields of study?

   1-2 If field of study does not moderate the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion, then do social interactions with faculty predict female Ph.D. students' degree completion?

2. Does field of study moderate the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion?

   2-1 If field of study moderates the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion, then do academic interactions with faculty predict female Ph.D. students' degree completion in respective fields of study?

2-2 If field of study does not moderate the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion, then do academic interactions with faculty predict female Ph.D. students' degree completion?

3. Does field of study moderate the predictive relationship between research productivity and female Ph.D. students' degree completion?

3-1 If field of study moderates the predictive relationship between research productivity and female Ph.D. students' degree completion, then does research productivity predict female Ph.D. students' degree completion in respective fields of study?

3-2 If field of study does not moderate the predictive relationship between research productivity and female Ph.D. students' degree completion, then does research productivity predict female Ph.D. students' degree completion?

The statistical software package, SPSS 15.0 was used to perform binary logistic regression on the following hypotheses which were derived from above research questions:

H_1: Field of study does not moderate the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion.

$H_{1-1, 2}$: Social interactions with faculty do not predict female Ph.D. students' degree completion.

H_2: Field of study does not moderate the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion.

$H_{2-1, 2}$: Academic interactions with faculty do not predict female Ph.D. students' degree completion.

H_3: Field of study does not moderate the predictive relationship between research productivity and female Ph.D. students' degree completion.

$H_{3-1, 2}$: Research productivity does not predict female Ph.D. students' degree completion.

The survey was deployed and the invitation e-mail containing the URL to the online survey was sent to 191 former Ph.D. students on January 15, 2010. Subsequently, postcards containing the survey link were sent to 185 students whose e-mail addresses were not available. A reminder e-mail was sent two weeks after the original communication, and the survey was closed on February 22, 2010. There were 87 responses to the survey (23% response rate). One of the respondents was a male, so the case was deleted. The sample therefore consisted of 86 cases.

Participants' demographic characteristics, such as field of study, enrollment status, relationship status at the beginning of the program, number of dependents at the beginning of the program, ethnicity, and citizenship status are displayed in Tables 1-6.

Table 1. Field of study of the participants

Enrollment status	Degree completion		Total
	Completed	Not completed	
STEM	30 (45%)	12 (63%)	42 (49%)
Non-STEM	37 (55%)	7 (37%)	44 (51%)
Total	67 (100%)	19 (100%)	86 (100%)

Table 2. Enrollment status of the participants

Enrollment status	Degree completion		Total
	Completed	Not completed	
Full-time	36 (54%)	9 (47%)	45 (52%)
Part-time	23 (34%)	9 (47%)	32 (37%)
Other	8 (12%)	1 (6%)	9 (11%)
Total	67 (100%)	19 (100%)	86 (100%)

Table 3. Relationship status when started the program

Relationship status	Degree completion		Total
	Completed	Not completed	
Married or had a long-term committed partner	47 (70%)	10 (53%)	57 (67%)
Single, never married	14 (21%)	6 (31%)	20 (23%)
Separated	1 (2%)	0 (0%)	1 (1%)
Divorced	4 (5%)	3 (16%)	7 (8%)
Widowed	1 (2%)	0 (%)	1 (1%)
Total	67 (100%)	19 (100%)	86 (100%)

Table 4. Number of dependents when started the program

Number of dependents	Degree completion		Total
	Completed	Not completed	
0	42 (63%)	12 (63%)	54 (63%)
1	13 (19%)	3 (16%)	16 (19%)
2	7 (10%)	3 (16%)	10 (12%)
3	2 (3%)	0 (0%)	2 (2%)
4 or more	1 (2%)	0 (0%)	1 (1%)
No data	2 (3%)	1 (5%)	3 (3%)
Total	67 (100%)	19 (100%)	86 (100%)

Table 5. Ethnicity of the participants

Ethnicity	Degree completion		Total
	Completed	Not completed	
Asian or Pacific Islander	5 (7%)	2 (11%)	7 (9%)
Bi- or multi- ethnic	1 (2%)	1 (5%)	2 (2%)
Black/African American, not of Hispanic origin	5 (7%)	1 (5%)	6 (7%)
Hispanic, not Caucasian	1 (2%)	1 (5%)	2 (2%)
White, not of Hispanic origin	53 (79%)	14 (74%)	67 (78%)
Other	2 (3%)	0 (100%)	2 (2%)
Total	67 (100%)	19 (100%)	86 (100%)

Table 6. Citizenship status of the participants

Citizenship status	Degree completion		Total
	Completed	Not completed	
U.S. citizen or U.S. national	56 (84%)	16 (85%)	72 (84%)
U.S. permanent resident visa (green card)	0 (0%)	1 (5%)	1 (1%)
Temporary visa (F-1, J-2, etc.)	11 (16%)	2 (10%)	13 (15%)
Total	67 (100%)	19 (100%)	86 (100%)

Variables within the dataset are described in Table 7. The dependent variable was degree completion (1 = completed, 0 = not completed). The moderator variable was field of study (1 = STEM fields, 0 = non-STEM fields). The predictor variables were social interactions with faculty, academic interactions with faculty, and research productivity. All of the predictor variables were continuous in nature, and descriptive statistics (ranges, means, and standard deviations) of the predictor variables are shown in Table 8. Tables

9-10 present the descriptive statistics of the three predictor variables divided into two groups, completed and not-completed.

Table 7. Variables within the dataset

Variables		Levels	Recoded
Dependent variable	Degree Completion	Completed Not-completed	1 0
Moderator variable	Field of study	STEM Non-STEM	1 0
Predictor variables	Social Interactions with faculty	Satisfaction: low to high	Total score of five items: lowest=0, highest=25
	Academic Interactions with faculty	Satisfaction: low to high	Total score of six items: lowest=0, highest=30
	Research Productivity	Frequency: low to high	Total score of four items: lowest=9, highest=20

Table 8. Descriptive statistics of the predictor variables

	N	Minimum	Maximum	Mean	Standard Deviation
Social interactions with faculty	86	9.0	25.0	20.22	4.33
Academic interactions with faculty	86	11.0	30.0	23.06	4.75
Research Productivity	86	0	11.0	3.52	2.72

Table 9. Descriptive statistics of the predictor variables for completers

	N	Minimum	Maximum	Mean	Standard Deviation
Social interactions with faculty	67	9.0	25.0	20.67	4.06
Academic interactions with faculty	67	11.0	30.0	23.55	4.60
Research Productivity	67	0	11.0	3.57	2.74

Table 10. Descriptive statistics of the predictor variables for non-completers

	N	Minimum	Maximum	Mean	Standard Deviation
Social interactions with faculty	19	10.0	25.0	18.63	4.98
Academic interactions with faculty	19	11.0	30.0	21.32	4.99
Research Productivity	19	0	8.0	3.37	2.69

Of the 86 cases, 67 were completers and 19 were non-completers. Forty-four students were enrolled in the STEM fields and 42 were enrolled in the non-STEM fields. Cross-tabulation of degree completion and field of study is provided in Table 11.

Table 11. Cross-tabulation of degree completion and field of study

Field of study	Degree completion Completed	Not completed	Total
STEM	30 (71%)	12 (29%)	42 (49%)
Non-STEM	37 (84%)	7 (16%)	44 (51%)
Total	67 (78%)	19 (22%)	86 (100%)

The following is a summary of the logistic regression analysis for each hypothesis. For the moderator variable, overall model fit was examined by observing the -2 log likelihood before and after the insertion of the product term. If the moderator effect was observed for the predictor variable, then the logistic regression analysis would be conducted separately for each field of study (STEM and non-STEM). If no moderator effect was observed, then the logistic regression analysis would be conducted for the entire sample. Evaluation of the logistic regression models were based on the statistical tests of individual predictors and goodness-of-fit statistics (Peng, Lee, & Ingersoll, 2002). If individual predictor variables within the models were significant, logistic regressions would be performed using only the significant predictor variables to determine if there were more efficient prediction models. The p-value or statistical significance was set at $p = 0.05$ for all hypotheses.

DATA ANALYSES

Research question 1: Does field of study moderate the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion?

Hypothesis 1: Field of study does not moderate the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion.

The -2LL for the first model was 85.649, and for the second model, 85.640. The difference between the two values, which was 0.009, did not exceed the critical value (3.841) of chi square distribution with $df = 1$, alpha = .05, not rejecting the null hypothesis. This meant that the model fit did not increase with the addition of product term (field of Study x social interactions with faculty), suggesting that there is no

moderator effect of field of study on the predictive relationships between social interactions with faculty and female Ph.D. students' degree completion (See Tables 12-13).

Table 12. Analysis of moderator effect of field of study on the predictive relationship between social interactions with faculty and degree completion

Predictor	B	$S.E.$	$Wald$	df	p	$Exp\ (B)$ (odds ratio)
Block 1						
Constant	-.424	1.212	.122	1	.726	.654
Social interaction	.106	.060	3.142	1	.076	1.112
Field of study	-.757	.546	1.919	1	.166	.469
Block 2						
Constant	-.307	1.728	.032	1	.859	.736
Social interaction	.100	.088	1.293	1	.256	1.105
Field of study	-.978	2.373	.170	1	.680	.376
Field of Study x Social interaction	.012	.121	.009	1	.924	1.012

Table 13. Model summary on the analysis of moderator effect of field of study on the predictive relationship between social interactions with faculty and degree completion

Step	-2 Log likelihood	Cox & Snell R^2	Negeklerke R^2
1	85.649	.058	.090
2	85.640	.059	.090

Research question 1-1: If field of study moderates the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion, then how do social interactions with faculty predict female Ph.D. students' degree completion in respective fields of study?

Research question 1-2: If field of study does not moderate the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion, then how do social interactions with faculty predict female Ph.D. students' degree completion?

Hypotheses 1-1, 2: Social interactions with faculty do not predict female Ph.D. students' degree completion.

Results of the logistic regression analysis indicate that the one-predictor model does not provide a statistically significant improvement over the constant-only model, X^2 ($N = 86$) = 3.20, p =.074. The Nagelkerke pseudo R^2 indicated that the model accounted for only 6% of the total variance. Tables 14-15 present the regression coefficients (B), the Wald statistics, significance level, and odds ratio [Exp (B)]. The Wald test reports that the predictor variable (social interactions with faculty) was not a statistically significant predictor of female Ph.D. students' degree completion (see Tables 14-15).

Table 14. Logistic regression analysis of social interactions with faculty and degree completion

Variable entered	*B*	*S.E.*	*Wald*	*df*	*p*	*Exp (B) (odds ratio)*
Constant	-.814	1.165	.488	1	.485	.443
Social interactions with faculty	.105	.059	3.177	1	.075	1.111

Table 15. Model summary on the logistic regression of social interactions with faculty and degree completion

Step	-2 Log likelihood	Cox & Snell R^2	Negeklerke R^2
1	87.628	.037	.056

Research question 2: Does field of study moderate the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion?

Hypothesis 2: Field of study does not moderate the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion.

The -2LL for the first model was 85.665, and for the second model, 84.999. The difference between the two values, which was 0.675, did not exceed the critical value (3.841) of chi square distribution with df = 1, alpha = .05, not rejecting the null hypothesis. This meant that the model fit did not increase with the addition of product term (field of Study x academic interactions with faculty), suggesting that there is no moderator effect of field of study on the predictive relationships between academic interactions with faculty and female Ph.D. students' degree completion (see Tables 16-17).

Table 16. Analysis of moderator effect of field of study on the predictive relationship between academic interactions with faculty and degree completion

Predictor	B	S.E.	Wald	df	p	Exp (B) (odds ratio)
Block 1						
Constant	-.496	1.265	.154	1	.695	.609
Academic interaction	.096	.055	3.097	1	.078	1.101
Field of study	-.749	.546	1.883	1	.170	.473
Block 2						
Constant	.734	2.047	.129	1	.720	2.083
Academic interaction	.041	.089	.210	1	.646	1.042
Field of study	-2.800	2.624	1.138	1	.286	.061
Field of Study x Academic interaction	.093	.115	.648	1	.421	1.097

Table 17. Model summary on the analysis of moderator effect of field of study on the predictive relationship between academic interactions with faculty and degree completion

Step	-2 Log likelihood	Cox & Snell R^2	Negeklerke R^2
1	85.665	.058	.089
2	84.999	.066	.101

Research question 2-1: If field of study moderates the predictive relationship between

academic interactions with faculty and female Ph.D. students' degree completion, then

how do academic interactions with faculty predict female Ph.D. students' degree

completion in respective fields of study?

Research question 2-2: If field of study does not moderate the predictive relationship

between academic interactions with faculty and female Ph.D. students' degree completion,

then how do academic interactions with faculty predict female Ph.D. students' degree

completion?

Hypotheses 2-1, 2: Academic interactions with faculty do not predict female Ph.D.

students' degree completion.

Results of the logistic regression analysis indicate that the one-predictor model

does not provide a statistically significant improvement over the constant-only model, X^2

(N = 86) = .081, p =.776. The Nagelkerke pseudo R^2 indicated that the model accounted

for only 1% of the total variance. Table presents the regression coefficients (B), the Wald

statistics, significance level, and odds ratio [Exp (B)]. The Wald test reports that the

predictor variable (social interactions with faculty) was not a statistically significant

predictor of female Ph.D. students' degree completion (see Tables 18-19).

Table 18. Logistic regression analysis of academic interactions with faculty and degree
completion

Variable entered	B	S.E.	Wald	df	p	Exp (B) (odds ratio)
Constant	-.923	1.225	.567	1	.451	.398
Academic interactions with faculty	.097	.055	3.174	1	.075	1.102

Table 19. Model summary on the logistic regression of academic interactions with faculty and degree completion

Step	-2 Log likelihood	Cox & Snell R^2	Negeklerke R^2
1	87.628	.037	.056

Research question 3: Does field of study moderate the predictive relationship between research productivity and female Ph.D. students' degree completion?

Hypothesis 3: Field of study does not moderate the predictive relationship between research productivity and female Ph.D. students' degree completion.

The -2LL for the first model was 87.908, and for the second model, 87.329. The difference between the two values, which was 0.579, did not exceed the critical value (3.841) of chi square distribution with $df = 1$, alpha = .05, not rejecting the null hypothesis. This meant that the model fit did not increase with the addition of product term (field of Study x research productivity), suggesting that there is no moderator effect of field of study on the predictive relationships between research productivity and female Ph.D. students' degree completion (see Tables 20-21).

Table 20. Analysis of moderator effect of field of study on the predictive relationship between research productivity and degree completion

Predictor	B	S.E.	Wald	df	p	Exp (B) (odds ratio)
Block 1						
Constant	1.502	.496	9.171	1	.002	4.492
Research productivity	.056	.098	.328	1	.567	1.058
Field of study	-.810	.546	2.199	1	.138	.445
Block 2						
Constant	1.911	.738	6.697	1	.010	6.758
Research productivity	-.079	.190	.174	1	.676	.924
Field of study	-1.398	.920	2.308	1	.129	.247
Field of Study x Research productivity	.183	.223	.676	1	.411	1.201

Table 21. Model summary on the analysis of moderator effect of field of study on the predictive relationship between research productivity and degree completion

Step	-2 Log likelihood	Cox & Snell R^2	Negeklerke R^2
1	88.479	.027	.041
2	87.809	.035	.053

Research question 3-1: If field of study moderates the predictive relationship between research productivity and female Ph.D. students' degree completion, then how does

research productivity predict female Ph.D. students' degree completion in respective

fields of study?

Research question 3-2: If field of study does not moderate the predictive relationship

between research productivity and female Ph.D. students' degree completion, then how

does research productivity predict female Ph.D. students' degree completion?

Hypotheses 3-1, 2: Research productivity does not predict female Ph.D. students' degree

completion.

Results of the logistic regression analysis indicate that the one-predictor model

does not provide a statistically significant improvement over the constant-only model, X^2

($N = 86$) = .081, p =.776. The Nagelkerke pseudo R^2 indicated that the model accounted

for only 6% of the total variance. Table 22 presents the regression coefficients (B), the

Wald statistics, significance level, and odds ratio [Exp (B)]. The Wald test reports that the

predictor variable (social interactions with faculty) was not a statistically significant

predictor of female Ph.D. students' degree completion (see Tables 22-23).

Table 22. Logistic regression analysis of research productivity and degree completion

Variable entered	B	S.E.	Wald	df	p	Exp (B) (odds ratio)
Constant	-.923	1.225	.567	1	.451	.398
Academic interactions with faculty	.097	.055	3.174	1	.075	1.102

Table 23. Model summary on the logistic regression of research productivity and degree completion

Step	-2 Log likelihood	Cox & Snell R^2	Negeklerke R^2
1	87.628	.037	.056

CHAPTER 5

CONCLUSION AND DISCUSSION

SUMMARY OF STUDY

This study sought to further understand whether or not field of study moderated the predictive relationships between social interactions with faculty, academic interactions with faculty, research productivity, and female Ph.D. students' degree completion. The research questions were:

1. Does field of study moderate the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion?

   1-1 If field of study moderates the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion, then do social interactions with faculty predict female Ph.D. students' degree completion in respective fields of study?

   1-2 If field of study does not moderate the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion, then do social interactions with faculty predict female Ph.D. students' degree completion?

2. Does field of study moderate the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion?

   2-1 If field of study moderates the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion, then do academic interactions with faculty predict female Ph.D. students' degree completion in respective fields of study?

2-2 If field of study does not moderate the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion, then do academic interactions with faculty predict female Ph.D. students' degree completion?

3. Does field of study moderate the predictive relationship between research productivity and female Ph.D. students' degree completion?

3-1 If field of study moderates the predictive relationship between research productivity and female Ph.D. students' degree completion, then does research productivity predict female Ph.D. students' degree completion in respective fields of study?

3-2 If field of study does not moderate the predictive relationship between research productivity and female Ph.D. students' degree completion, then does research productivity predict female Ph.D. students' degree completion?

Following hypotheses were derived and tested from above research questions:

H_1:   Field of study does not moderate the predictive relationship between social interactions with faculty and female Ph.D. students' degree completion.

$H_{1\text{-}1,2}$: Social interactions with faculty do not predict female Ph.D. students' degree completion.

H_2:   Field of study does not moderate the predictive relationship between academic interactions with faculty and female Ph.D. students' degree completion.

$H_{2\text{-}1,2}$: Academic interactions with faculty do not predict female Ph.D. students' degree completion.

H_3:   Field of study does not moderate the predictive relationship between research

productivity and female Ph.D. students' degree completion.

$H_{3-1,2}$: Research productivity does not predict female Ph.D. students' degree completion.

The sample of this study was all female students who were enrolled in Ph.D.

programs at a large, public, research university in the mid-Atlantic region between 1993

and 2004. An online survey was administered to collect data on the participants'

satisfaction with student-faculty social and academic interactions, research productivity,

whether or not the participant completed the degree, as well as program and demographic

information.

Collected data were analyzed using logistic regression analysis. The moderator

effect of field of study was first analyzed to determine if there was a significant

difference in the predictive relationships between the predictor variables (social and

academic interactions with faculty and research productivity) and dependent variable

(degree completion) depending on the field of study (STEM or non-STEM). If a

moderator effect was observed, then logistic regression analysis was conducted separately

for students in the STEM fields and students in the non-STEM fields to determine if the

predictor variable had predictive utility on degree completion. If no moderator effect was

observed, then logistic regression analysis was conducted for the entire sample.

SUMMARY OF FINDINGS

Logistic regression was used to test the previously stated hypotheses to determine

if field of study moderated the predictive relationships between social and academic

interactions with faculty, research productivity, and degree completion of female Ph.D. students.

Field of study

Results of the logistic regression analyses indicated that for all three predictor variables (social and academic interactions with faculty and research productivity), the model fit increase was not statistically significant with the inclusion of the product terms. Each of the null hypotheses was not rejected, suggesting that there was no moderator effect of field of study on the predictive relationships between social and academic interactions with faculty and research productivity and female Ph.D. completion.

Social interactions with faculty

Results of the logistic regression analysis indicated that the one-predictor model did not suggest the predictive utility of social interactions with faculty on degree completion. Null hypothesis was therefore not rejected, indicating that social interactions with faculty did not predict female Ph.D. degree completion.

Academic interactions with faculty

Results of the logistic regression analysis indicated that the one-predictor model did not suggest the predictive utility of academic interactions with faculty on degree completion. Null hypothesis was therefore not rejected, indicating that academic interactions with faculty did not predict female Ph.D. degree completion.

Research productivity

Results of the logistic regression analysis indicated that the one-predictor model did not suggest the predictive utility of research productivity on degree completion. Null hypothesis was therefore not rejected, indicating that research productivity did not predict female Ph.D. degree completion.

CONCLUSIONS

DISCUSSION

The sample of this study included 86 respondents of the Survey of Doctoral Students' Experiences. Among the 86 respondents, 67 had completed the degree and 19 had not. The majority of the respondents (84%) were U.S. citizens or U.S. nationals, and 78% were Caucasians. This is due to the nature of data collection, which relied heavily on the alumni office of the research site to gain access to the sample's current contact information. International students, most of whom leave the U.S. to go back to their home countries, could not have been reached because their current contact information was not available.

In terms of the relationship attributes of the sample, 70% of the students who had completed the degree had been married or had a long-term committed relationship when the program started, while the percentage of non-completers was 53%. Furthermore, 21% of the completers were single, while the percentage of non-completers who were single was 31%. The relationship status did not change over time for most respondents (68% of completers and 63% of non-completers claimed that their relationship status remained the same); however, 16% of the non-completers divorced or became a widow

during the time they were in their Ph.D. programs. Completers tended to be in committed relationships and had fewer incidents of separation, whereas non-completers appeared to be fewer in committed relationships and had a higher rate of experiencing separation in their relationships. The presence of a partner and how relationship status affects the likelihood of degree completion needs to be explored in future studies.

The characteristics of the non-completers deserve special attention. One of the notable differences between completers and non-completers was whether or not they took a leave of absence during the time they were in the program. Results revealed that 52% of the non-completers had taken a leave of absence, while only 19% of the completers did. Moreover, 32% of the non-completers took more than a year of leave of absence, whereas only 9% of the completers took a leave of absence longer than 1 year. The reasons for leaving the program varied among non-completers. In addition, 37% listed family needs as one of the reasons for leaving; work and financial reasons were second and third most common reasons for the departure. These differences could be explored further to see how leaves of absence affect female doctoral students.

Field of study

The result of this study was contrary to the current literature that report disciplinary differences in academic environments, especially with those that emphasized a distinct difference in experiences of female students in male-dominated fields (Pedrioli, 2004). Disciplines, as many researchers have attested, are central to doctoral students' experiences and must be taken into consideration when trying to understand the matters relating to doctoral education (Austin, 2002; Golde & Dore, 2004; Hopwood, McAlpine

&Harris-Huemmert, 2008). Golde and Walker (2006) argued that the particular

department in which doctoral students are located is central to disciplinary socialization.

Studies have found that women in male-dominated fields have lower self-concepts (Ulku-

Steiner et al, 2000) and have lower research productivity than men (Nettles & Millett,

2006).

The analyses of this particular dataset revealed that there was no statistically

significant difference between STEM and non-STEM fields in terms of their predictive

relationships between social and academic interactions with faculty and research

productivity on degree completion. This is not to suggest that female students in STEM

fields and non-STEM fields had similar experiences. Rather, it suggests that the outcome

of doctoral degree completion was not moderated by field of study for this research work.

It has to be noted that quantitative research design is sometimes not capable of

capturing subtle contextual differences that may affect the outcome (Bair & Haworth,

1999; Golde, 2000; Malone, Nelson & Nelson, 2004). In this study, there was a

comment box at the end of the online survey in which participants could write anything

they wanted about their experience as a doctoral student. In the comment section, some

participants described their experiences of gender discrimination in STEM fields. A

participant in the college of sciences wrote, "In my particular track, women were second

class citizens. My advisor often put me down and made me feel like he was doing a

favor by allowing me to stay in the program." Another participant in the college of

sciences wrote; "some tenures, older, male faculty believe that females should not receive

Ph.D.s and deliberately tried to fail/sabotage female students on their comprehensive

exams. I was told that I was taking the food out of the mouths of babies by taking a male

job." These statements, though not included in this study's overall quantitative analyses, reveal gender discrimination in sciences and are congruent with many of the existing literature that report male-dominant academic environments that are non-accommodating and hostile to women (Gardner, 2008; Herzig, 2004; Settles, Cortina, Malley & Stewart, 2006; Stark, 2008; Xu, 2008).

Social interactions with faculty

Social interactions with faculty refer to the students' satisfaction with the general relationship that develops between students and faculty in and outside of classrooms, such as the quantity and frequency, as well as the quality, of casual conversations and social functions involving both faculty and students. With regards to social interactions with faculty, Hoskins and Goldberg (2005) found that faculty relationships that nurture the social-personal component of the student program match were essential in the decision of counseling students' decision to persist in the doctoral program. Existing literature emphasize the role of socialization in doctoral student success and degree completion (Gardner, 2008; Gardner & Barnes, 2007; Turner & Thompson, 1993). Social interactions with faculty is one of the ways in which students are socialized into the program environment, a way to learn the values, norms, knowledge, beliefs, the interpersonal and other skills that facilitate role performance (Clark & Concoran, 1986). Pascarella (1984) demonstrated the importance of student-faculty interactions across a variety of settings as having a positive influence on students' orientation to achievement.

In this study, participants' satisfaction with social interactions with faculty during the course of their program experiences did not predict degree completion. In other

words, there was no statistically significant difference of the level of satisfaction with social interactions with faculty between the students who completed and the students who did not complete. Further investigation is needed to understand the effects of social interactions with faculty on the overall socialization process. Furthermore, the effects of successful socialization on degree completion need to be established.

Additional variables such as professional role commitment - commitment to academic career and the discipline - may be useful in understanding the dynamic process of doctoral student socialization and its effects on degree completion. Austin (2002) and Weiss (1981) both focused on the role of graduate education in the development of students' 'professional role commitment' or 'conceptions of the academic career and faculty role'. Weiss (1981) found that the nature and frequency of student-faculty interactions proved to have significant influence on professional commitment. The next question would be to understand how professional commitment is related to degree completion.

Academic interactions with faculty

Academic interactions with faculty refer to the students' satisfaction with the quality of faculty instruction, faculty availability to meet with students, faculty academic advising, faculty feedback on projects and academic progress, faculty interest in student research, professional advising, and job placement by faculty (Nettles & Millett, 2006). Academic interactions with faculty often promote academic integration, and studies suggest that better advising interactions with supportive faculty enhance students'

academic experiences and reduce attrition probabilities (Ehrenberg, Jakubson, Groen & Price, 2007; Kurtz-Costes, Helmke & Ulku-Steiner, 2006).

This study did not prove predictive utility of satisfaction with academic interactions with faculty on female Ph.D. students' degree completion. The scale here is not how much the student in academically integrated, but rather, how satisfied they were with their academic interactions with faculty. Therefore, for this study, no inferences could be made to Tinto's (1993) notion that academic integration achieved through the acquisition of knowledge and the development of academic competencies deemed necessary for doctoral research are important for successful doctoral completion. Further study is needed to link academic interactions with faculty with successful academic integration, and how satisfaction is related to academic integration.

Research productivity

Research productivity refers to research activities of Ph.D. students while they are pursuing their degrees. Such activities include conference presentations, journal articles and book chapters as well as book publications. According to Nettles and Millett (2006), research productivity is an important predictor of doctoral degree completion in all fields. Their study demonstrated that students in sciences and mathematics with research productivity were 3.9 times more likely to complete their doctorates than those without.

Contrary to the Nettles and Millett's (2006) findings, the results of this study did not demonstrate predictive utility of research productivity over degree completion. Although not a direct predictor of degree completion, the role of research productivity is deemed important in professional development and socialization of doctoral students

(Nettles & Millett), and is listed as one of the most important dimensions of graduate training (Wong & Sanders, 1983). Research productivity is also reported as having notable influence on time to degree, a dimension that was not addressed in this study. There is a need for more studies on research productivity to understand its role in professional development and how it affects the overall socialization process.

LIMITATIONS

This was a focused study that included very specific measures. Inevitably, it faces several research limitations that need to be discussed. This study was retrospective in nature, and does not take into consideration the three distinct stages of doctoral degree attainment as described by Tinto (1993): (1) transition and adjustment, (2) candidacy and development of competence, and (3) completing the research project. This study did not address how successful or unsuccessful completion of one stage would affect the completion of the next stage, and how time spent in the program influences the nature of student-faculty interactions and the outcomes of research productivity.

This study was also limited to using the participants' "satisfaction" with the social and academic interactions with faculty as it was impossible to measure the frequency and the quality of student-faculty interactions from when the participants were in the program. Although satisfaction is a legitimate measure, it has to be noted that "satisfaction" and "perceived service quality" are two different constructs (Spreng & Mackoy, 1996).

FUTURE RESEARCH CONSIDERATIONS

This study examined the predictive utilities of social and academic interactions with faculty and research productivity on female Ph.D. students' degree completion, and it also explored field of study differences in these predictive relationships.

The results of this study revealed no moderator effect of field of study and no predictive utility of the predictor variables. Future studies could refine the survey and the indexes as well as to increase the number of variables to be examined. Given the limitations of a dissertation research, this study focused on a small number of variables that explored doctoral student experiences as it relates to degree completion. As stated in the introduction, current knowledge about doctoral degree completion is that no one factor explains the complex nature of student behaviors of degree completion or non-completion. There are institutional, cultural, personal, social, financial, and many other factors that could affect female doctoral students' degree completion. To build upon this study, one may look at other measures related to social and academic integrations of female doctoral students, such as the development of professional role commitment and how it is shaped through interactions with program elements. Analyses of demographic data of the participants revealed that there were notable differences in relationship status and how they changed over time as well as whether or not she took a leave of absence between completers and non-completers. One may explore these specific variables and try to understand how they affect their degree completion.

This study also calls for a more in-depth qualitative study that could capture some of the subtle field of study differences and how they relate to degree completion. Bair and Haworth (1999) stated:

There exists a strong need for qualitative research that seeks to gain directly from students their thoughts, feelings, and behaviors regarding continuation or attrition. Such studies have the potential to shed more light on the importance of previously identified variables as well as surface new factors or combinations of factors that play a central role in attrition and retention. (p. 28)

The need for qualitative studies on doctoral student experiences is expressed by many other researchers (Bair & Haworth, 1999; Golde, 2000; Malone, Nelson & Nelson, 2004).

One important point to make is that doctoral degree completion and attrition are not simply a matter of academic success or no success. Ph.D. students make career and personal decisions during the course of the program, and those decisions are often made consciously about their life and career path. Some choose to leave the institution to work in the corporate world or to have children and focus on child-rearing. Lovitts (2001) urges to study the career trajectories of doctoral degree non-completers. Understanding why and how female doctoral students choose to leave the program and move to a different career –both in the professional sense and in the personal sense - will provide important information about helping female doctoral students succeed.

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APPENDICES

APPENDIX A: COVER LETTER TO PILOT STUDY PARTICIPANTS

Date _____

Dear Student:

My name is Miki Yoshimura, and I am a doctoral candidate at XXX University.

The purpose of this letter is to request your assistance in the collection of data for a study. I would like to ask you to please review the survey and identify weaknesses and errors in the survey before it is mailed to more than 400 former XXX students. I am seeking feedback about the length of time to complete the survey, ease and user-friendliness of the survey, quality and comprehensiveness of questions, and any other ways to enhance the survey.

I am asking that you please (1) read the survey instructions, (2) read the enclosed comprehensive survey cover letter and survey instructions, (3) complete the survey, and (4) complete the questionnaire about the survey.

Strict confidentiality will be maintained, and your responses will not be released to any other party. The aggregate (collection of) survey responses will not be reported in a manner that will violate individual confidentiality.

If you have any questions, please contact me at myoshimu@xxx.edu (000) 000-0000. Thank you for your support!

Sincerely,

Miki Yoshimura

APPENDIX B: PILOT STUDY SURVEY INSTRUCTIONS

Purpose of Survey
The purpose of the survey is to seek feedback about the Survey of Ph.D. Student Experiences being conducted by Miki Yoshimura so that it can be enhanced before it is mailed to approximately 400 individuals. I am asking you to please review the survey and identify weaknesses and errors in the survey. I am seeking feedback about the length of time to complete the survey, ease and user-friendliness of survey, quality and comprehensiveness of questions, and other ways to enhance the survey.

Enclosures
Enclosed are (1) the draft cover letter, (2) survey instructions and the link to the online survey, and (3) link to the online questionnaire about the survey

Confidentiality
The survey results will remain the property of the researcher. Strict confidentiality will be maintained, and your responses will not be released to any other party. The aggregate (collection of) survey responses will not be reported in a manner that will violate individual confidentiality.

Survey Length and Questions
The draft survey will take less than 10 minutes to complete. Most of the questions require you to select the number that represents the most appropriate answer. It is important that you answer all of the questions, because each answer has a direct effect on the results of the survey. Some questions may have responses that do not always reflect your exact thinking. Nonetheless, please choose the answer that best represents your thoughts and ideas. Whatever comes to mind first is typically the best response.

After you complete the survey, please complete the document called "Questionnaire for pilot study participants." The questionnaire will take only five minutes to complete. Please answer candidly, keeping in mind that your responses will help us to improve the survey.

Completing the Survey and Questionnaire
It would be helpful if you could please complete the survey and questionnaire by ---, 2009.

Questions
If you have any questions, please contact Miki Yoshimura (a doctoral student at XXX University) at myoshimu@xxx.edu or (000) 000-0000.

Appreciation
Thank you in advance for your participation. Your opinions are important and truly appreciated. You are helping to add valuable knowledge to research about Ph.D. students.

APPENDIX C: QUESTIONNAIRE FOR PILOT STUDY PARTICIPANTS

	Strongly Agree	Agree	Disagree	Strongly Disagree
1. The cover letter of the survey motivated me to complete the survey.	4	3	2	1
2. The survey instructions are easy to understand.	4	3	2	1
3. I clearly understand the survey items.	4	3	2	1
4. None of the terminology is too difficult.	4	3	2	1
5. The survey assumes an inappropriately low level of knowledge, and it drags on too slowly for me.	4	3	2	1
6. The survey is not too wordy.	4	3	2	1
7. There is no unnecessary redundancy.	4	3	2	1
8. The questions offer all possible response options.	4	3	2	1
9. The response options are mutually exclusive (to make it easier to select among them).	4	3	2	1
10. There are no places of the survey that causes me confusion.	4	3	2	1
11. The survey is an appropriate length.	4	3	2	1
12. The survey took longer than 10 minutes to complete.	4	3	2	1

(*Optional*): **Please add any comments that may be helpful.**

APPENDIX D: E-MAIL TO FORMER PH.D. STUDENTS

Dear Former Ph.D. Student,

My name is Miki Yoshimura, and I am a student at XXX University conducting a survey of Ph.D. student experiences, in partial fulfillment of my doctoral degree in Education.

The purpose of the study is to understand the relationship between doctoral degree completion and experiences in the doctoral programs at XXX. This study is specifically targeted to female students, and you have been carefully chosen to participate in this study, if you could please participate in a survey that will take less than 10 minutes to complete.

To participate, please click the link below. Your participation is critical to my dissertation research, and will be greatly appreciated. It will also be used for the betterment of female experiences in doctoral programs. If you have any questions, please feel free to contact me at myoshimu@xxx.edu or (000)000-0000.

https://periwinkle.ts.edu/surveys/WRUDG5/

Thank you!

Miki Yoshimura
Doctoral Candidate, XXX University

P.S. As an incentive, there will be a drawing for two **$50 Amazon gift certificates**. The drawing will take place on February 22.

APPENDIX E: POST CARD TO FORMER PH.D. STUDENTS

Dear Former Ph.D. Student,

My name is Miki Yoshimura, and I am a student at XXX University conducting a survey of Ph.D. student experiences, in partial fulfillment of my doctoral degree.

The purpose of the study is to understand the relationship between doctoral degree completion and experiences in the doctoral programs at XXX University. The aim is to enhance the understanding of Ph. D. student experiences so as to improve the quality of graduate education. This study is specifically targeted to female students, and you have been carefully chosen to participate in this study. If you could please participate in a survey that will take only about 10 minutes.

To participate, please send an e-mail to myoshimu@xxx.edu and tell me that you are interested in participating in the survey. All I need is your e-mail address, as the survey will be conducted online. **Please be assured that your e-mail address will not be used for any purpose other than to send you the link to the online survey, and it will not be shared by any other party.** The aggregate survey responses will not be reported in a manner that will violate individual confidentiality.

If you prefer to go directly to the survey, please use the following URL to the online survey.

https://periwinkle.ts.edu/surveys/WRUDG5/

Your participation and support will be greatly appreciated, as the knowledge gained through this study will be used for the betterment of female experiences in doctoral programs. If you have any questions, please contact Miki Yoshimura at myoshimu@xxx.edu or (000) 000-0000. Thank you!

Sincerely,
Miki Yoshimura
Doctoral Candidate, XXX University

P.S. As an incentive, there will be a drawing for two $50 Amazon certificates. Details at the survey link.

APPENDIX F: SURVEY OF DOCTORAL STUDENT EXPERIENCES

Survey of Doctoral Student Experiences

Developed By

Miki Yoshimura
Doctoral Student, XXX University

in Partial Fulfillment of the Requirement for the
Degree of Doctor of Philosophy
in Higher Education

Page 1

Thank you for participating in this research on doctoral students. You are one of a carefully selected sample of former doctoral students who have studied at XXX University. Your participation is critical to the success of this study, to improve the policies and practices of doctoral programs at XXX University and graduate education as a whole.

Your responses will be combined with those of other participants and will be reported as group averages. Your individual responses will be kept confidential and never connected with your name in any report. No student will be individually identified in any of the analyses or reports.

Please click 'Next' to proceed.

Page 2

A. Instruction: Based on your personal experience, indicate your level of satisfaction with each of the following by checking the appropriate response.

1. Quality of personal relationships developed with faculty members in the program.
{Choose one}
( ) Very Satisfied
( ) Satisfied
( ) Neither Satisfied nor Dissatisfied
( ) Dissatisfied
( ) Very Dissatisfied

2. Quality of contact between professors and students in my program outside the classroom
{Choose one}
( ) Very Satisfied
( ) Satisfied
( ) Neither Satisfied nor Dissatisfied
( ) Dissatisfied
( ) Very Dissatisfied

3. Collegial atmosphere between the faculty and students
{Choose one}
( ) Very Satisfied
( ) Satisfied
( ) Neither Satisfied nor Dissatisfied
( ) Dissatisfied
( ) Very Dissatisfied

4. Communication between faculty and students

{Choose one}
    ( ) Very Satisfied
    ( ) Satisfied
    ( ) Neither Satisfied nor Dissatisfied
    ( ) Dissatisfied
    ( ) Very Dissatisfied

5. Quality of overall faculty-student relations
{Choose one}
    ( ) Very Satisfied
    ( ) Satisfied
    ( ) Neither Satisfied nor Dissatisfied
    ( ) Dissatisfied
    ( ) Very Dissatisfied

Page 3

6. Quality of faculty instruction
{Choose one}
    ( ) Very Satisfied
    ( ) Satisfied
    ( ) Neither Satisfied nor Dissatisfied
    ( ) Dissatisfied
    ( ) Very Dissatisfied

7. Availability of the faculty to meet with students
{Choose one}
    ( ) Very Satisfied
    ( ) Satisfied
    ( ) Neither Satisfied nor Dissatisfied
    ( ) Dissatisfied
    ( ) Very Dissatisfied

8. Quality of academic advising provided by faculty
{Choose one}
    ( ) Very Satisfied
    ( ) Satisfied
    ( ) Neither Satisfied nor Dissatisfied
    ( ) Dissatisfied
    ( ) Very Dissatisfied

9. Quality of feedback on scholarly projects or academic progress
{Choose one}
    ( ) Very Satisfied
    ( ) Satisfied
    ( ) Neither Satisfied nor Dissatisfied

( ) Dissatisfied
( ) Very Dissatisfied

10. Quality of professional advising and job placement
{Choose one}
    ( ) Very Satisfied
    ( ) Satisfied
    ( ) Neither Satisfied nor Dissatisfied
    ( ) Dissatisfied
    ( ) Very Dissatisfied

11. Faculty interest in my research
{Choose one}
    ( ) Very Satisfied
    ( ) Satisfied
    ( ) Neither Satisfied nor Dissatisfied
    ( ) Dissatisfied
    ( ) Very Dissatisfied

Page 4

B. Instruction: Indicate how many times you have done the following activities while you enrolled in your Ph.D. program.

12. Published an article in a journal
{Choose one}
    ( ) 0
    ( ) 1 time
    ( ) 2 times
    ( ) 3 times
    ( ) 4 times
    ( ) 5 or more times

13. Published a chapter in a book
{Choose one}
    ( ) 0
    ( ) 1 time
    ( ) 2 times
    ( ) 3 times
    ( ) 4 times
    ( ) 5 or more times

14. Published a book
{Choose one}
    ( ) 0
    ( ) 1 time

( ) 2 times
( ) 3 times
( ) 4 times
( ) 5 or more times

15. Presented a paper at a conference
{Choose one}
   ( ) 0
   ( ) 1 time
   ( ) 2 times
   ( ) 3 times
   ( ) 4 times
   ( ) 5 or more times

Page 5

16. Years attended Old Dominion University as a Ph.D. student

From year:
{Enter text answer}
[   ]

17.

 to year:
{Enter text answer}
[   ]

18. Did you take a leave of absence in that period?
{Choose one}
   ( ) No
   ( ) Yes

19. If yes, how long was your leave of absence?
{Choose one}
   ( ) 1 semester
   ( ) 2 semesters
   ( ) about 1 year
   ( ) between 1 and 2 years
   ( ) between 2 and 3 years
   ( ) more than 3 years
   ( ) Not applicable

20. Which college did you attend?
{Choose one}
   ( ) Arts & Letters

( ) Business
( ) Engineering
( ) Education
( ) Health Sciences
( ) Sciences
( ) Other (specify) [   ]

21. What was the name of your program? (specify)
{Enter text answer}
[   ]

22. What was the gender proportion of your program?
{Choose one}
    ( ) There were more men than women in my program
    ( ) There were more women than men in my program
    ( ) There were about the same number of men and women in my program

23. What was your enrollment status while you were in your Ph.D. program?
{Choose one}
    ( ) Full time
    ( ) Part time
    ( ) Other [   ]

Page 6

24. What was your relationship status when you started your Ph.D. program?
{Choose one}
    ( ) Married or had a long-term committed partner
    ( ) Single, never married
    ( ) Separated
    ( ) Divorced
    ( ) Widowed

25. What was your relationship status when you finished or stopped your Ph.D. program?
{Choose one}
    ( ) Same as above
    ( ) Was married or in a committed relationship but separated or divorced or widowed
    ( ) Was separated but got divorced
    ( ) Was single, divorced, or widowed but got married or had a committed partner
    ( ) Other [   ]

26. How many children (under 18) and/or dependents who lived with you did you have when you started your Ph.D. program?
{Enter text answer}

[   ]

27. Did you complete the doctoral degree?
{Choose one}
    ( ) Yes (go to 28)
    ( ) No (go to 29, 30, and 31)

28. If yes, what year did you graduate?
{Enter text answer}
[   ]

29. If no, what year did you stop pursuing the degree?
{Enter text answer}
[   ]

30. If no, what was the reason for stopping? Please select all the reasons that apply to you.
{Choose all that apply}
    ( ) Lack of social fit with my program
    ( ) Financial reasons
    ( ) Family needs
    ( ) Health reasons
    ( ) Worked at a job
    ( ) Changed occupational priorities
    ( ) Traveled or moved
    ( ) Got married
    ( ) Started a family
    ( ) Academic difficulties
    ( ) Lack of academic fit with my program
    ( ) Other reasons (specify) [   ]

31. If no, which stage were you in when you stopped pursuing your degree?
{Choose one}
    ( ) I was doing my course work
    ( ) I had passed the candidacy or comprehensive exam
    ( ) I was ABD (all but dissertation)
    ( ) Other [   ]

Comment
{Enter text answer}
[   ]

Page 7

32. What is your gender?
{Choose one}

( ) Female
( ) Male

33. What is your ethnicity?
{Choose all that apply}
    ( ) Asian or Pacific Islander
    ( ) Bi- or multi-racial/ethnic
    ( ) Black/African American, not of Hispanic origin
    ( ) Hispanic, not Caucasian
    ( ) Middle Eastern
    ( ) Native American
    ( ) White, not of Hispanic origin
    ( ) Other [   ]

34. Citizenship status when you started your Ph.D. program:
{Choose one}
    ( ) U.S. citizen or U.S. national
    ( ) U.S. permanent resident visa (Green card)
    ( ) Temporary visa (F-1, J-1, etc)
    ( ) Other [   ]

35. If you have a permanent resident card or temporary visa (F-1, J-1, etc), please name your country of citizenship.
{Enter text answer}
[   ]

36. What was your gross (before tax) income from your earnings last year (2009)?
{Choose one}
    ( ) Less than $9,999
    ( ) $10,000-19,999
    ( ) $20,000-29,999
    ( ) $30,000-39,999
    ( ) $40,000-49,999
    ( ) $50,000-59,999
    ( ) $60,000-69,999
    ( ) $70,000-79,999
    ( ) $80,000-89,999
    ( ) $90,000-99,999
    ( ) $100,000-149,999
    ( ) $150,000-199,999
    ( ) more than 200,000

37. (Optional): Is there anything else you would like us to know about your experience as a doctoral student at Old Dominion University?
{Enter answer in paragraph form}
[   ]

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Thank you for your cooperation! If you would like to enter for a drawing of two $50 Amazon gift certificates, please leave your e-mail address below.

Your response and your e-mail address will be stored separately in order to maintain your confidentiality. Your e-mail will only be used for the drawing, will not be shared with any other party, and will be removed from the server as soon as the drawing takes place (sometime in February 2010).
{Enter text answer}
[   ]

Would you be open to participating in future study?
{Choose one}
    ( ) Yes
    ( ) No

Please don't forget to click "Finish" after you complete the survey.

Exit Page

APPENDIX G: FOLLOW-UP E-MAIL

Dear Former Ph.D. student,

About two weeks ago, I sent you an invitation e-mail to an online survey for my dissertation research project. I really appreciate that many of you have responded, but I would like to remind those of you who have not, that the survey is still available. I hope that you will be able to spend 5-10 minutes of your time to participate in the survey.

There will be a drawing for **two $50 Amazon gift certificates**. Your chance of winning is not so bad, as this is a very focused study, and I am sending this e-mail to a very limited number of people.

Here is the survey link. Thank you again for your time and consideration.

https://periwinkle.ts.edu/surveys/WRUDG5/

If you have questions or concerns, please feel free to e-mail me at myoshimu@xxx.edu.

Thank you,

Miki Yoshimura
XXX University
myoshimu@xxx.edu