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Timely Doctoral Completion Rates in Five Fields:

A Two-Part Study

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Education
Department of Adult, Career, and Higher Education
College of Education
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DEDICATION

In loving memory of my father, Harry Schulz.

Dad – I think of you often and will always be grateful for your love and guidance.

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ACKNOWLEDGMENTS

First of all, to my Mom – thank you for your loving encouragement over all these years, and for babysitting Isabelle and Gabriel while I finished up my coursework. I could not have done this without you. To my husband, Caleb – I love you with my whole heart. After all these years, you are still the greatest guy I know. Thank you for loving me, supporting me, and helping me stay the course. I would also like to acknowledge Susannah Olsen and Adrianna Brown for all the hours that they lovingly babysat my children while I worked on this dissertation. It gave me such peace of mind to often hear my children laughing in the next room. To my major advisor, Dr. Donald Dellow, and to the rest of my committee – Dr. John Ferron, Dr. James Eison, and Dr. Deidre Cobb-Roberts — I cannot thank you enough for your time and effort. It was a privilege to work with all of you on my dissertation, and I am so grateful for each and every one of your suggestions. I would also like to acknowledge Dr. Jim Voytuk for his assistance in retrieving the student data included in this study. Finally, I want to thank my Lord and Savior, Jesus Christ, for all the blessings in my life and specifically for supplying everything I needed to cross this finish line.

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ABSTRACT

Roughly half of all doctoral students who begin a program do not continue through graduation, and many of them face significant financial losses and emotional burdens as a result. Although this completion rate has stayed fairly constant for the past few decades, it has recently gained attention on a national level. In 2011, the National Research Council published the *Assessment of Research Doctorate Programs in the United States*, and provided a wealth of data on over 5,000 programs in 212 universities. This study used that dataset to examine the relationship between timely doctoral completion rates and 22 *Program*, *Faculty* and *Student* variables in the following five fields: Neuroscience, Chemical Engineering, Physics, Economics and English. The study also observed differences between programs with high completion rates and those with low completion rates in each field. The purpose of the study was to (1) determine which variables are significant in predicting doctoral completion rates, (2) discover if measurable differences exist between high and low completing programs, and (3) reveal the usefulness of collecting objective data in doctoral programs in order to assist doctoral programs as they create strategies to lower attrition rates.

The sample in the study included over 10,000 students and over 12,000 faculty members from 365 programs in the five fields. The 22 variables in the study were: Availability of a Graduate Orientation, Existence of an Annual Student Review, Number of Academic Support Activities, Average First Year Enrollment Size, Total Number of Enrolled Students, Percentage of First Year Students with Full Financial Support, Percentage of Students that are Teaching

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Assistants, Percentage that are Research Assistants, Median Time to Degree, Average GRE Score, Percentage of Students that are Married, Percentage of Students with Dependents, Percentage of Students with Mentors, Average Satisfaction Rating, Average Sense of Belonging Rating, Percentage of Students that are Females, Percentage that are Minorities, Percentage of Faculty that are Females, Percentage that are Minorities, Percentage of Faculty with Grants, Total Number of Faculty, and Faculty to Student Ratio. All of the regression lines were significant at the $p \leq .05$ level. Furthermore, for the *Economics* programs in the sample, 80% of the variance in timely completion rates was explained by this specific set of variables, and the same set of variables explained between 40-66% of the variance in timely completion rates for the other four fields in the study.

When looking at all the programs in the dataset, the following variables were significantly related to timely completion rates: number of academic support activities, percentage of students with full financial support, 1st year size, annual student review, student satisfaction rating, number of faculty, percentage of students with teaching assistantships, percentage of faculty with grants, and time to degree. Between the high- and low-completion groups, the following variables were significantly different in the *All Programs* group: Student satisfaction rating, percentage of students with children, percentage of students with full financial support, number of academic support activities, time to degree, and percentage of students with teaching assistantships. Separate findings and implications are presented for each of the five fields (*Neuroscience, Chemical Engineering, Physics, Economics* and *English).* Program leaders and other interested parties can now use these results to focus their attention on significant variables as they create strategies for improving completion rates within their respective fields.

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CHAPTER ONE

INTRODUCTION

Background of the Problem

Increasingly, higher education is focusing its efforts upon the necessity to retain and graduate doctoral students. Roughly fifty percent of students who begin doctoral programs do not persist to graduation, a rate that may be exceeded by students in underrepresented groups (Lovitts, 2001). This loss of an institution's doctoral contingency represents untold economic losses and immeasurable voids in research (Gilliam, 2006). Barbara Lovitts (2001) describes this high attrition rate (the percentage of an entering class that does not persist through graduation) in doctoral programs as higher education's "invisible problem." Doctoral students often withdraw quietly, hence the problem remains invisible.

According to Cusworth (2001), the graduate experience in general is a great, unaddressed academic issue within higher education. Nettles and Millett (2006) similarly voiced concern about the limited attention that scholars have given to researching issues in graduate education. Although some studies have similarly looked at relationships between specific variables and doctoral completion, the majority of them only looked at student or faculty variables within one institution, or at program variables within a limited number of institutions. This study, on the other hand, will look at program, student *and* faculty variables and their relationship to completion rates in multiple programs across multiple institutions. Furthermore, this study will

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examine differences between programs with high completion rates and those with low completion rates.[1]

Purpose of the Study

This researcher is using data from the National Research Council's *Data-Based Assessment of Research-Doctorate Programs in the United States* to examine the relationship between timely doctoral completion rates and 22 variables, and to compare high and low-completing doctoral programs in the following five fields: Neuroscience, Chemical Engineering, Physics, Economics and English. The purpose of this study is to (1) discover which variables are significant in predicting doctoral completion rates, (2) reveal how much of the variance in timely completion rates can be explained by measurable data; and (3) determine if there are measurable differences between high- and low-completing programs in order to assist doctoral programs as they create strategies to improve completion rates.

Rationale of the Study

It is currently up for debate whether current generations of scholars and teachers will be able to reproduce themselves. High-paying tech jobs are luring potential students away and applications to graduate school in several disciplines have begun to decline (Lovitts & Nelson, 2000). Under these circumstances, Lovitts and Nelson strongly urge that it is time to give serious attention to one of the fundamental weaknesses of doctoral education – attrition (2000). According to them, graduate programs have been surprisingly wasteful of their human capital. The amount of time needed to fulfill all requirements for a doctoral degree is also a matter of growing concern. Recent studies have shown that the longer a student spends in graduate school, the greater the likelihood of that student not persisting to graduation (Bowen & Rudenstine,

[1] This researcher is using the average completion rate in each field ± 10 percentage points to determine the cut-offs for high- and low-completing groups in each field. Exact cut-offs are listed in Table 6 (Chapter 4).

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1992; Ferrer de Valero, 1996, Nerad & Cerny, 1991). Gillingham et. al (1991) points out that the contributions that could have been made in the years spent working toward degree completion are costly both to students and to society as a whole – especially for those who do not complete their degree. There is also a burdensome financial cost for institutions when their students leave a program prior to completion. The University of Notre Dame, as a prime example, found that it would save $1-million a year in stipends alone if attrition was reduced by ten percent (Smallwood, 2004). Non-completers also pay a heavy emotional toll (Willis & Carmichael, 2011); some spend years explaining why they did not finish the degree (Sternberg, 1981), and others can struggle with serious bouts of depression (Hinchey & Kimmel, 2000; Lovitts, 2001).

Forty years of studies suggest the long-term attrition rate nationwide is roughly 50%, and that rate may have increased in recent years. Departments under pressure to downsize and economize are more and more likely to be held accountable for the costs of recruiting and training students who do not complete their degrees. An attrition rate of 50% is even less acceptable in smaller graduate programs and institutions (Lovitts & Nelson, 2000). Thus, additional research that compares high and low-completing programs, and investigates which variables contribute the most to timely completion, is both beneficial and necessary.

Research Questions

Tinto (1993) said that retention "must focus on the institution as well as on the student, and on the actions of the faculty and staff who are the representatives of the institution…" This researcher is examining which variables from these three groups – Programs, Students, and Faculty – contribute the most to timely completion rates, and is also examining which variables show significant differences between high and low completing programs in five fields. In other words, the researcher is addressing the following two research questions:

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1. What is the relationship between timely doctoral completion rates[2] and the following variables (availability of graduate orientations, number of student support activities, average first year enrollment size, total number of enrolled students, percent of first year students with full financial support, percent of students with teaching assistantships, percent with research assistantships, median time to degree, existence of an annual student review, average GRE score, percent of students that are married, percent of students with dependents, percent of students with mentors, average satisfaction ratings with program, average sense-of-belonging rating, percent of students that are female, percent that are minorities, percent of faculty with grants, percent of faculty that are females, percent that are minorities, total number of faculty, and faculty to student ratio) in the:
    a. *Neuroscience* field?
    b. *Chemical Engineering* field?
    c. *Physics* field?
    d. *Economics* field?
    e. *English* field?
    f. *All Programs* group from these 5 fields combined?
2. When comparing doctoral programs with high completion rates and those with low completion rates[3], which variables show statistically significant differences in the:
    a. *Neuroscience* field?
    b. *Chemical Engineering* field?

[2] Within 6 years for programs in Neuroscience, Chemical Engineering, Physics, Economics, or within 8 years for programs in English.
[3] Exact cut-offs for high- and low-completion groups in each field are presented in Table 6 (Chapter 4).

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c. *Physics* field?

d. *Economics* field?

e. *English* field?

f. *All Programs* group from these 5 fields combined?

Theoretical Framework

After years of contributing to the topic of undergraduate persistence, Tinto laid the foundation for a theory on doctoral student completion in his 1993 book on undergraduate attrition. Tinto went on to present a longitudinal model of doctoral persistence (see Figure 1, p. 13), but pointed out that one simple model could not fully describe the complexities of graduate persistence.

Tinto believed that doctoral completion could be affected by multiple factors including: student attributes, financial assistance, institutional and program experiences, academic and social integration into a program, and research experiences (Kluever, 1997). Tinto's model and theory was not offered as a strict formula, but rather as a comprehensive framework encompassing student, faculty and program factors. As such, this researcher is not examining all the components of the model but rather is seeking to address the most measurable variables that can be most influenced by a university program.

Methodology

The dependent variable (DV) in this study is the average completion rate of doctoral degrees within six years in Neuroscience, Chemical Engineering, Physics and Economics, or within eight years for programs in English.[4] The dependent variable is an *average* rate because completion rates were computed from five cohorts (groups of students who entered from 1996-

[4] These parameters of timely completion were set by the researchers of the original NRC study.

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97 to 2000-01) and then averaged. The independent variables in this study consist of Program, Student and Faculty Variables (see Table 1, p. 12). The researcher is employing the use of multiple regression, independent T-test and chi-square analyses to examine which factors contribute the most to timely completion rates in selected doctoral programs and to compare high and low completing programs across multiple variables. The level of significance for all tests (including the multiple independent T-tests) is set at.05 ($\alpha = .05$) to minimize Type II errors.

In multiple regression analysis, a mathematical formula is created to show the size and strength of a relationship between multiple variables and an outcome variable. For this study, data from the NRC's *Data-Based Assessment of Research-Doctorate Programs in the United States* is being analyzed to examine the relationships between Program, Student, and Faculty Variables and timely completion rates in doctoral programs. The analysis will further determine the R^2 value, which shows how much of the variation in the dependent variable can be accounted for by the 22 independent variables. Independent T-tests and chi-squares will then compare high and low completing programs across all 22 variables. To determine the cutoffs for each field's high- and low-completing groups, this researcher is using the national average of completion in each field ± 10 percentage points. Data analysis will be carried out using the SPSS program.

Limitations

The use of secondary data and non-experimental research methods did not allow the researcher to manipulate or control the dependent or independent variables. For instance, the parameter of timely completion was set by the previous researchers who produced the secondary dataset. The data collection process and the inclusion or exclusion of certain variables was outside the supervision of this researcher as well.

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Next, the student survey was completed by advanced students already admitted to candidacy and no individual follow-up was completed. As a result, an aggregate score from the student questionnaires had to be used rather than individual scores. Also, the student data that was collected in the original NRC study was limited to doctoral candidates from only five fields, due to the high cost of sending surveys to students in every field. Although it would have been ideal for every student to have been surveyed, the group that received the questionnaires represented 113 institutions (out of the original 212), and also represented every broad field except for Agricultural Sciences.

Finally, although the NRC performed numerous data and accuracy checks, details about the coordinators at each institution who responded to the questionnaires were not provided by the original study. Published critiques of this survey exist and these critiques are discussed at length in Chapter Two. Although aware of the issues related to secondary data use, this researcher believes that the ample sample size, quality and breadth of the data set outweighed the limitations.

Delimitations

This study is examining completion rates – not attrition, persistence or retention rates. *Completion* studies measure only final outcomes; whereas *persistence* studies track students through the various stages of attrition, and *retention* studies track continued registration (NSF, 1998). Thus, this research does not consider whether a non-completer left voluntarily or involuntarily from a program. Nor does it have any data pertaining to students' or faculty members' perceptions of why a non-completer left a program. Instead, this study is solely assessing the single outcome of completion and its relationship to multiple measurable variables.

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Secondly, this researcher purposefully did not include all the variables that were available from the original NRC dataset. Variables that came from the Institutional Questionnaire were left off since the unit of analysis for this study is the *program*, and not the institution. Variables calculated from an "Allocated Faculty" number were also not included. In the original study, a formula was used to allocate a percentage of contribution to each program for faculty members who worked in multiple programs. For the purposes of this study, the researcher decided to use raw numbers only rather than include those figures based on a formula.

In terms of methodology, the researcher decided a priori to select an alpha level of .05 for both the regression and independent T-test analyses. Although several independent T-tests will be conducted, the researcher selected an alpha level of .05 in an effort to limit Type II errors – the error of not rejecting the null hypothesis when it is false. Finally, 380 programs collected information from Programs, Faculty, and Students, however only 365 programs will be used in this study because 15 programs had missing information.

Significance of the Study

Roughly half of all doctoral students nationwide do not finish their degrees. This has been the case for decades, however recently this issue has gained a national audience. As more parties become interested in the transparency and accountability of doctoral programs, studies like this one that look at objective data to examine doctoral completion rates are needed. The wealth of data that was collected from the NRC has not been paralleled in the past. Thus, the analysis in this study is able to include numerous variables simultaneously. This inclusion of program, student *and* faculty variables should help explain a larger percentage of variance in completion rates. It should also reveal the usefulness or lack thereof in evaluating objective data when examining doctoral completion.

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The secondary dataset came from the NRC assessment, whose rankings have been called "the gold standard" by biomedical engineer John M. Tarbell and physicist Peter Woit, and in news releases by Cornell University and the University of California. The Center for Public Anthropology also praised the National Research Council's 2010 rankings as "an impressive achievement" for its move away from reputational rankings and toward data-based rankings." The multiple regression analyses, based on this reputable data, will present which factors are significantly related to timely completion rates. Program leaders and other interested parties can use these findings to determine which factors to focus on as they seek out ways to increase completion rates. In addition, the t-test and chi-square analyses will present a comparison between high and low completion groups, and reveal whether those differences are uniform across disciplines or unique to each field. Program administrators can then further use those findings to focus their efforts on variables that show significant differences between the two groups in their specific field.

As mentioned earlier, other studies have previously looked at relationships between specific variables and completion, however nearly all of the studies cited the limitation of small sample size. This study, on the other hand, has the advantage of a rather large sample size. Furthermore, previous studies generally used the *student* as the unit of analysis, whereas this study is using the *program.* Instead of looking at factors related to a specific student's completion or non-completion, this study is examining how factors relate to a program's overall completion rate, and thus puts the onus for change on the program.

Definition of Terms

The following definition of terms offers the reader a context for understanding the terminology in this study:

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All Programs Group – All 365 programs in the dataset from the following five fields: Neuroscience, Chemical Engineering, Physics, Economics and English.

Attrition – "The proportion of the entering cohort into a doctoral degree program that does not complete the graduate program undertaken" (*NSF,* 1998).

Dissertation Committee – A committee made up of graduate faculty that provides expertise and guidance throughout the dissertation process.

Cohort – A specific entering group of doctoral students.

NRC study – the National Research Council's *Data-Based Assessment of Research-Doctorate Programs in the United States* (2011).

Persistence – A student continuing progress toward doctoral degree completion.

Retention – the rate at which students continue in a program.

Socialization – the process of integrating into one's surrounding culture.

Timely Completion Rate – the number of students who graduated within six years in Neuroscience, Chemical Engineering, Physics and Economics, or who graduated within eight years in English, divided by the total number of students who initially enrolled in a specified program.

Organization of the Study

Chapter One contains an introduction to the study, the purpose and significance of the study, the research questions, limitations and delimitations, definition of terms, and an overview of the methodology. Chapter Two will provide a review of the literature. Chapter Three will describe the methodology used in the study, the instrument, the research design, and the procedures used to obtain the research data. Chapter Four will present an analysis of the data,

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and Chapter Five will contain a summary of the findings, conclusions, implications and future recommendations.

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Tables and Figures

Table 1: List of Independent Variables

Program Characteristics	*Student Characteristics within a Program*	*Faculty Characteristics within a Program*
▪ Availability of a graduate orientation ▪ Number of student support activities ▪ Average 1st year enrollment size ▪ Total number of students enrolled in the program ▪ Percent of first year students with full financial support ▪ Percent with teaching assistantships ▪ Percent with research assistantships ▪ Median time to degree ▪ Existence of an annual student review	▪ Average GRE score ▪ Percent of students that are married ▪ Percent of students with dependents ▪ Percent that have mentors ▪ Average satisfaction rating with overall quality of program ▪ Average sense-of-belonging rating ▪ Percentage of students that are females ▪ Percentage of students that are non-Asian minorities	▪ Percentage of faculty with grants ▪ Percentage of faculty that are females ▪ Percentage of faculty that are non-Asian minorities ▪ Total number of faculty ▪ Faculty to student ratio

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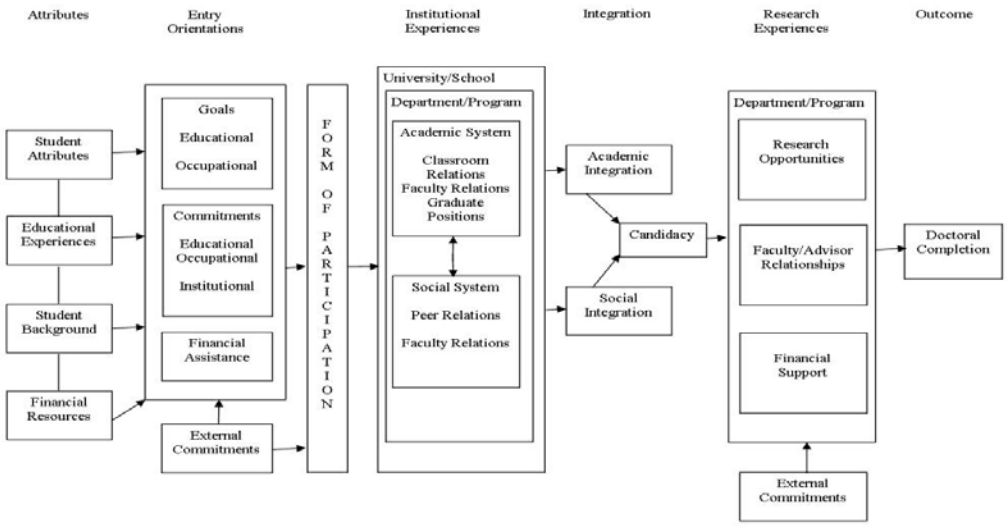

Figure 1: Tinto's Longitudinal Model of Doctoral Persistence

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CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

This chapter begins with a brief history of the doctoral degree and an overview of doctoral completion / attrition. It then reviews past studies on program, student or faculty variables and their relationships with doctoral student completion rates. Since there are numerous variables related to completion, the researcher used Tinto's Model of Doctoral Persistence (see Figure 1) to frame and structure this review. Studies in this section have been organized according to the following themes: program orientations and social activities, academic and student support, student characteristics, student finances, faculty research and faculty diversity. This chapter also includes an overview of the original NRC study, and then closes with recent national initiatives and current recommendations for lowering doctoral attrition rates.

Brief History of the Doctoral Degree

In Medieval Europe, study was categorized into four fields: the basic faculty of arts, and the three higher faculties of medicine, law, and theology. Initially the titles of master and doctor were used interchangeably, but by the late Middle Ages the terms Master of Arts and Doctor of Medicine, Doctor of Laws and Doctor of Theology had become widely accepted (DeRidder-Symoens, 2003; Pederson, 1997). Through the educational reforms in Germany in the early 19th century, the arts faculty began to require contributions to research for the award of their final degree – the Doctor of Philosophy (Ph.D.). Originally, the curriculum of the arts faculty was

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based upon the trivium and the quadrivium, but by the 19th century it had come to include all the subjects now typically referred to as sciences and humanities (Ruegg, 2004).

In 1861, Yale University adopted these German reforms and began granting the Ph.D. to students who had completed a specified course of graduate study in the humanities and sciences and who had successfully defended a dissertation containing original research. Edward Bouchet was the first African American to earn a doctorate degree from an American University in 1876. Then in 1877, Helen Magill White was the first woman to earn the Ph.D. in the United States. In 1900, the degree spread from the United States to Canada, and later in 1917, to the United Kingdom (Simpson, 1983).

Overview of Doctoral Completion and Attrition

According to Clark (1995), American doctoral programs are the premier training ground for the world's future scientists and scholars. Yet there is little research available on doctoral completion or attrition. Research on the attrition rates of undergraduate students, on the other hand, is much more substantial. Cooke et al. (1995) suggests that universities find it less strategically important to follow up on doctoral students who do not complete due to the lesser volume of students involved. Furthermore, students who drop out are often difficult to locate, and the ones who are found provide information from recollections, which may change over time.

In 1999, Bair and Haworth provided an overview of 118 doctoral persistence and attrition studies completed between 1970 and 1998. They found that (1) attrition and persistence rates vary widely depending on field of study, and even more widely depending on program of study; (2) departmental culture affects doctoral student persistence; (3) difficulties with the dissertation relate to attrition; (4) academic achievement indicators, with the exception of graduate record

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examination scores, are not effective predictors of degree completion; (5) employment and financial factors are poor indicators of persistence; and (6) retention rates vary widely among institutions (Bair & Haworth, 1999). Bair and Haworth provided an impressive overview of previous research on this topic, however the majority of the studies looked only at one program or one university and several cited the major limitation of small sample size. Using secondary data, this researcher is able to analyze data from 365 programs at 113 institutions.

Program Factors Related to Completion

It can be tempting to consider attrition solely at the individual level. Either the student did not have the "right stuff" intellectually or emotionally, or some external event (family, illness) intervened. While this allows for individual variation and nuance, it removes responsibility for attrition from the institution or the department (Golde, 1996; Nerad & Miller, 1996). Golde mentioned that another reason for this individualistic focus is that many studies have focused on student persistence, rather than looking at student attrition; "The persistence perspective puts the onus for achievement on the student, and obscures institutional or structural barriers to success" (Golde, 1994). However, Cooke et al. (1995) argued that a student's detachment or isolation from a program – and not necessarily his individual characteristics – is what makes him more likely to drop out. While it can be argued that students determine their degree of involvement throughout their educational journey, programs are responsible for providing activities and establishing an encouraging environment for students to participate. This section looks at the impact of orientations and social activities, as well as the impact of academic and student support, on the academic success of doctoral students.

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Orientations and Social Activities

Observers of the graduate community are acknowledging that "many graduate students when first entering their respective programs are just as confused and anxious as they were as new undergraduates" (Rosenblatt & Christensen, 1993). Boyle and Boice (1998) suggest that orientations are one of the most useful tools in helping students acclimate to the new environment of graduate education. They go on to explain that since it is the department culture (and not necessarily the university culture) to which graduate students need to adjust, it would be beneficial to supplement a campus-wide orientation with a departmental one. Ideally, orientations acquaint students to the norms and requirements of that particular department, plus they introduce incoming graduate students to key members of the department – including faculty, staff and advanced graduate students (Boyle & Boice, 1998).

Studies indicate that orientation programs tend to increase persistence and retention (e.g. Phillips, Daubman & Wilmoth, 1986; Washburn, 2002) and to reduce incoming student anxiety (Vlisides & Eddy, 1993). Such anxiety and stress is fairly common among new graduate students (Baird, 1990; Golde, 2000), and research shows that a welcoming environment is crucial in alleviating this stress and creating a smoother transition for the graduate student (Poock & Love, 2001; Rosenblatt & Christensen, 1993). It logically follows that the lack of departmental orientation and advising has been reported as negatively affecting student completion rates (Bowen & Rudenstine, 1992, Nerad & Cerny, 1993).

In addition to orientations, graduate organizations can also assist students in acclimating to graduate school. These organizations serve several functions including: (a) advocating on behalf of graduate students, (b) identifying issues that are important to graduate students, and (c) ensuring that concerns of graduate students are addressed (Coultier et al., 2004). According to

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Coultier et al. (2004), professional development workshops and social interaction with peers are two of the most expressed needs of graduate students. Tinto (1988) believes it is this social and intellectual integration that is key to a student's academic success and persistence.

Academic and Student Support

The term academic support typically describes academic assistance such as research conferences, writing workshops, and library / computer seminars. Pinkston (1987) found that institutions with academic support programs were associated with higher retention rates than institutions without those programs. Presumably, by the time a student enters doctoral study, he has already had ample research and writing experience. However, this is not always the case. For international students in particular – which make up as much as 50% of the student body in engineering fields – writing support can mean the difference between the successful completion of a degree or the decision to leave early.

In a study on the persistence of African-American doctoral students, King and Cherypator (1996) found that the majority of the students who persisted made use of the educational tools that were available at their doctoral institutions (including computer labs, research assistance and library instruction). Barker et al. (1997) similarly found that students who were 25 and older gave high priority rankings to academic advising and library /computer services. Lovitts (2001) suggests that for graduate students in general, student- faculty relationships and student involvement in academic life play an even bigger role in student persistence than social peer interaction.

Student Factors Related to Completion

Many educators and institutions want to "blame" attrition on students or on student capacity. Gilliam suggests that this is faulty thinking since there are typically no academic

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differences between completers and non-completers as evidenced by GRE scores and undergraduate GPA (2006). The idea that the admissions department is responsible for the 50% attrition rate also seems unlikely as the criteria for acceptance is often set at a high bar. Furthermore, most demographic variables (including age, race and sex) do not conclusively distinguish those who persist from those who do not (Bair & Haworth, 1999).

Although a student's background can strongly influence the initial choice of an undergraduate institution as well as the decision to eventually enroll in graduate school (Ethington, 1986), the decision to stay normally depends on a much more complex set of factors (Ferrer de Valero, 2001). Ferrer deValero goes on to explain that individual characteristics, financial support and type, motivation and ability may all contribute to a student's decision to persist. Dolph (1983) suggests moving away from investigations of students' demographic variables altogether and moving toward more intrinsic research. Although motivational variables are not included in the current research dataset, this researcher will look at the impact of students' relationship ratings, their sense of belonging, as well as their financial support as suggested by Ferrer de Valero.

Student Characteristics

Past research has evaluated numerous student characteristics; this section will begin with demographic and psychological measures, and then conclude with research findings specifically related to the variables in the current study. Gittings (2010) looked at student and program variables at two institutions in Kentucky, and found that enrollment status of the student (part-time or full-time) and the increase of age of the respondent have a positive influence on doctoral degree completion. A strong commitment to completion and personal persistence were also found to be critical to success (Golde, 2006). Deci and Ryan (1992) looked at extrinsic and

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intrinsic motivation and discovered that a student's sense of "competence and self-determination" could affect his/her motivation to persist. Similarly in King and Chepyator-Thompson's (1996) study on the persistence of African-American students, intrinsic motivation was most often cited by respondents who completed their degrees. One respondent wrote, "Those who graduated looked within themselves to find the strength, desire and focus they needed to reach their goals and these inner qualities guided them successfully through their doctoral experience" (King & Chepyator, 1996). According to Cooke et al. (1995), intent to remain, affective commitment, and need for achievement were all significant predictors of attrition.

Studies that have examined the relationship between GRE scores and doctoral degree completion contradict each other (Bair & Haworth, 1999), and undergraduate GPA was found to be related to doctoral student persistence in only a few studies (Cook & Swanson, 1978; Pristo, 1977). In addition, several other academic indicators have been studied, such as type and quality of undergraduate institution (Boozer, 1972) and junior/senior GPA (Lunneborg & Lunneborg, 1973). According to Bair and Haworth (1999), the majority of research evidence suggests that students' academic characteristics in general are not reliable predictors of persistence through graduation for doctoral students.

In past research, race and sex were often found to have an effect on degree completion; white students typically have lower attrition rates than minority students (Naylor & Sanford, 1982, Zwick, 1991), and men have lower attrition rates than women (Bowen & Rudenstine, 1992, Girves & Wemmerus, 1988). In the STEM fields, Lott, Gardner and Powers (2009) found that the odds of attrition are greater for females, Asians, and for those in the hard-applied science majors. In 2005 alone, 45% of all doctorates conferred were given to those in the science and

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engineering fields (Hoffer et al., 2006). Of those degrees, however, a disproportionate number (66%) were awarded to non-U.S. citizens, once again raising concerns about the future of STEM research in the United States (Council on Postsecondary Education, 2007).

Lovitts and Nelson (2000) pointed out that although women have higher attrition rates than men, they typically have higher undergraduate GPAs so the higher attrition rate is probably not an ability issue. In Cohen's study (2011), nurses pursuing a Ph.D. often found it difficult to balance their studies, work and care of their families. Female students in particular reported feeling overwhelmed with multiple life responsibilities and management of numerous priorities (Lee, 2006). An older study found that women were at a disadvantage in finding role models and mentors, which could help explain the lower graduation rates as well (Berg & Ferber, 1983), and Felder (2010) mentioned that African-Americans similarly have a difficult time finding the right advisor. For students who do connect with a suitable mentor, the process of navigating through degree requirements can become much smoother. Based on their 2006 survey, Nettles and Millett indicated that a substantive mentoring relationship with a faculty member was positively related to the completion of a PhD or EdD. They further reported that 70% of doctoral students who persisted to graduation had a close supporting mentoring relationship (2006). West, Gokalp et. al (2011) similarly found that having a positive working relationship with the dissertation chair was vital to students' success.

Student Finances

Two of the most commonly cited barriers to completion in a doctoral program are financial problems and pressures (Jones, 1987; Leadabrand, 1985). Ehrenberg and Mavros (1995) found that students who received fellowships or research assistantships had higher completion rates than those with teaching assistantships or who were totally self-supporting.

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Although teaching and research assistants both receive financial support, research assistants generally have higher completion rates arguably because of the valuable experience they gain as researchers, which aids them during the dissertation process. Girves and Wemmerus suggested that students with teaching and research assistantships are more likely to complete their doctorates because they are more likely to seek involvement in their programs and have the added benefit of engagement from faculty members (1998).

For most students, earning money while working on a dissertation is a major concern. For self-supporters, being employed often detracts from time that could be spent on the dissertation. One respondent in Gillingham, Seneca and Taussig's (1991) study wrote, "Paid employment had more immediate demands so the dissertation was put off indefinitely." Benkin (1984) further found that students' financial status affected how quickly they completed their dissertations, and hence how quickly they graduated. Ferrer de Valero (2001) agreed that a lack of financial support lowers students' possibility to successfully graduate in a shorter amount of time. However, unlike Ehrenberg, he found that completion rates were higher for students with teaching assistantships than for those with fellowships – at least in the humanities and social science fields (Ferrer de Valero, 2001).

Faculty Factors Related to Completion

The majority of studies that look at faculty's impact on attrition levels focus on the relational aspects between faculty / major advisor and student (Bargar & Chamberlain, 1983; Heinrich, 1995; Ferrer de Valero, 2001). This researcher will instead look at the impact of faculty's personal rather than relational factors, such as research experience and diversity.

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Faculty Research

An orientation toward scholarship at an institution is characterized by faculty who are accessible to students, who are actively engaged in scholarly activities themselves and who clearly convey expectations and encouragement for students to engage in those activities (Weidman & Stein, 2003). While it seems obvious that students with a stronger research background would have an easier time completing their dissertations, it is less obvious how faculty's involvement with research affects degree completion.

Nerad and Cerny (1993) found that graduate students who were encouraged to "dive into research" at the beginning of their programs often had shorter time to degrees. Fairweather (2005) noted that although faculty are often rewarded more for research than for teaching, there has been an increase in time spent by faculty on both research activities and teaching over the last two decades – as well as a resulting decrease in time spent on advising or counseling (Milem, 2001). Some studies found that this increase in research production hinders faculty from assisting doctoral students in their endeavors, while other studies have found that faculty's active engagement in research encouraged students to do the same. Hollingsworth and Fassinger (2002), for example, found that research mentoring experiences make a notable contribution to students' research productivity, and Krebs, Smither, and Hurley (1991) noted the positive relationship between a student's perception of his research training environment and his subsequent research productivity.

Faculty Diversity

Literature on the recruitment of diverse faculty centers on minority populations and mostly uses the traditional definition of diversity (Sims, 2004). Sims (2004) goes on to explain that a diverse faculty usually includes members of the traditional racial and ethnic minority

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groups (African-Americans, Asians, Hispanics/Latinos, Native Americans and Pacific Islanders). When looking at the low recruitment of minority faculty, studies cite multiple reasons such as small pools of qualified faculty candidates, absent mentoring and support programs on college campuses, feelings of isolation, and racist campus environments (Quezada & Louque, 2004; Dunn, 2005). Carriulo (2003) dismissed the "small pools of qualified candidates" notion by pointing out that the number of chemistry Ph.D.s awarded to African-Americans has actually doubled since 1990. He further stated that there is "a pipeline of qualified minority doctoral graduates from which universities can recruit, but these qualified individuals are recruited by their industries, historically black colleges and universities, and other employers."

Other scholars believe the search or selection processes used at colleges are to blame. Smith et al.'s study (2004) suggested that "intentional hiring strategies will be required to promote success in the hiring of most underrepresented faculty outside of ethnic studies departments… however… because faculty success is dependent on department support and mentoring, continued research is needed to look at the success of faculty appointed with such interventions". Other research focused on how the organizational structure and climate of a campus contributes to the attrition rate of minority faculty (Price et al., 2005). Quezada & Louque (2004) suggested that "schools and departments with high rates of attrition among faculty of color need to… recognize that something within their culture is causing faculty of color to leave."

In relation to completion, Felder (2010) found that increased levels of students and faculty diversity positively affect socialization, especially that of minority doctoral students. In one qualitative study, an African-American student reported that he was told "tales of failure" more often that tales of success, and felt that African-American mentors might be more inclined

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to collaborate on research related to minority issues (Felder, 2010). Fortunately, some programs have begun to address the under-representation of African American and Hispanic faculty. The McKnight Fellowship Program in Florida, for example, awards tuition plus an annual stipend to selected African American and Hispanic applicants in the hopes of increasing minority enrollment in Ph.D. programs, and thus increasing the future pool of minority faculty candidates. Other programs – like AGEP and DIMAC – similarly aim to increase the number of underrepresented minorities obtaining graduate degrees, and better prepare them for faculty positions.

The Original NRC Study

This study analyzes program, student and faculty data that was provided by the National Research Council in 2011. The original study, *A Data-Based Assessment of Research-Doctorate Programs in the United States*, collected an unprecedented amount of data relating to research productivity, student support / outcomes and program diversity from over 5000 programs at over 200 U.S. institutions. This impressive data set covered multiple variables, and was made available electronically to allow for the updating of important information on a continual basis. It was the intent of the NRC study to measure traits of doctoral programs in order to allow comparisons among programs within a field of study and to provide a basis for self-improvement within the disciplines (Ostriker et. al., 2011).

Earlier NRC reports that were published in 1982 and 1995 provided doctoral program rankings based on faculty opinions of program quality. In these previous studies, the ratings and rankings were derived from surveys in which faculty members were asked to assess the scholarly quality and effectiveness in education of individual doctoral programs in their own fields (Ostriker et. al., 2011). After the 1995 study was published, there was a widespread reaction that

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one reputation-based measure was an inadequate means of describing and assessing the full range of US doctoral programs. In response to that reaction, the most recent NRC study used objective data rather than a reputational measure to estimate overall quality of doctoral programs. The extensive reliance on data in the latest NRC study required the collection of an enormous amount of information that had not been routinely or systematically collected by doctoral programs in the past. Graduate schools, program administrators, institutional researchers, and individual doctoral faculty all spent countless hours gathering and clarifying the information on which the NRC assessment was based. As a result, this focus on data collection has improved practices for recording quantitative information in doctoral programs and for allowing qualitative assessments of doctoral programs to be based on that information. Although the assessment went on to present two possible ways of ranking doctoral programs, the committee considered the rankings to be illustrative, and declared that "the most important benefits of this study will flow from examination and analysis of the data that were collected", rather than from the rankings themselves (Ostriker et. al.,2011).

The program was chosen as the primary unit for analysis because programs admit students, offer degrees, and are the "obvious target of student interest" (Ostriker et. al., 2011). The program questionnaire (see Appendix A), which requested information on the size, scope, and other components of each program, was electronically sent to each institution's research office. It also included questions on financial aid and training practices. Additional information was collected about time to degree and completion rates, and whether the program followed student progress completion. The faculty questionnaire (see Appendix B), which was sent to all faculty identified as doctoral faculty by their respective institutions, collected data on work history, funding, publications, and demographic characteristics. The faculty questionnaire also

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asked respondents to rate the relative importance of program and faculty productivity, and to rate the relative importance of components within those two larger categories (Ostriker et. al., 2011). Faculty members were asked to do these ratings so that the illustrative rankings would be based on measures that were ranked most important by faculty. The student questionnaire (see Appendix C) gathered information about student educational background and demographic characteristics, as well as research experiences, scholarly productivity, and satisfaction with multiple aspects of the program. Questionnaire and response rates from the NRC Assessment are provided in Table 2 (p.36).

When the report was finally published in 2011, readers quickly pointed out that the data was already dated (five years old), and that the methodologies used to derive the two illustrative rankings were flawed. Many readers expected the study to be similar to NRC's previous study from 1995, which provided a clear ranking of programs within each discipline. However, in the opening chapter of the NRC 2011 publication, the committee immediately stated that "the reader who seeks a single, authoritative declaration of the 'best programs' in given fields will not find it in this report." Instead, this NRC report sought out to present the various quantitative aspects of each program and then let the reader decide which variables were important to them. The committee provided two *illustrative* rankings, but pointed out that several approaches could be used to evaluate and rate programs based on the data. This lack of a definitive ranking proved to be a disappointment to many readers who were eagerly waiting to compare results from the 1995 study. Neither contention (dated data nor multiple methodologies) is a hindrance in the present researcher's study; this researcher is examining the relationships between specific variables and timely completion rates and is only interested in the data collected for the report – not the rankings nor the ranking methodologies.

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Other issues that were noted with the NRC Assessment fall into the following categories: Omissions, Interdisciplinary issues/faculty allocations, Classification errors/ranking-related problems, and Clerical mistakes/possible input errors. Table 3 (p. 36) contains a description of each of these issues and an explanation of how the current research is either unaffected or minimally affected by each issue.

The NRC Dataset

In the NRC study – as well as the current study – Ph.D. programs were the unit of analysis. The NRC study defined a program as a unit of graduate study that performed at least three of the following four activities:

1. Enrolled students in doctoral study
2. Designated its own faculty
3. Developed its own curriculum
4. Recommended students for doctoral degrees

In addition to meeting these criteria, a program must also have produced at least five doctorates between 2001-2002 and 2005-2006 to have been included in the study. Seventy-two percent of the doctoral programs in the dataset came from public universities. Data collection was administered by the project's survey contractor, Mathematica Policy Research (MPR), and to preserve confidentiality, replies were sent directly to MPR.

The student dataset came from the Admitted-to-Candidacy Doctoral Student Questionnaires that were completed online by doctoral candidates in five fields. The five fields were Neuroscience, Chemical Engineering, Physics, Economics, and English. These fields were selected because of their large size and because they represented all but one of the broad fields.

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Although all programs vary in their own established set of regulations, programs in these fields typically have the following requirements in addition to their set of core and elective courses:

Neuroscience:

- Students are generally engaged in research during every quarter.
- The core curriculum often includes laboratory rotations, which allows students to explore possible laboratories for thesis work.
- Students are strongly encouraged to attend seminars or weekly one-hour colloquiums.
- There is typically a minimum teaching requirement of one quarter.
- Students generally begin as research apprentices and then pursue their own investigations (culminating in a dissertation or thesis).

Chemical Engineering:

- Students can enter with a bachelor's or master's degree (as most institutions do not offer a terminal master's degree).
- Research is heavily emphasized from the beginning of the program.
- Students are generally required to complete a minimum of two teaching assistantships.
- Students must pass a written and/or oral qualifying exam and defend a research proposal.
- Some programs require a written dissertation and/or a dissertation defense, while others require a presentation at a technical conference.

Physics:

- Students can enter with a bachelor's or master's degree; an M.S. degree is usually an intermediary step in the program.
- Research is the central focus of the degree and is often conducted in collaboration with a Physics faculty member.

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- Admission to candidacy is usually based on a research proposal and defense (rather than a comprehensive examination).
- Students generally complete a thesis based on original research and present the results in a final defense.

Economics:

- General written examinations in microeconomics and macroeconomics are typically administered at the end of the first year of study.
- Students must also successfully pass two field exams within the next year of study.
- Generally, a paper requirement must be completed by the third year of study and presented in a seminar.
- A written dissertation is generally required, but many programs do not require an oral defense.

English:

- There is usually a foreign language requirement (either mastery in one foreign language or proficiency in two).
- After a comprehensive exam in the third year, students generally begin exploring a dissertation topic under the guidance of an advisor.
- Students are normally expected to complete a book-length thesis of original work. Some programs allow “creative dissertations” in the form of a novel, a novella or a collection of poetry.

There were originally 12,138 responses to the student questionnaires. Programs that returned ten or fewer student questionnaires were removed from the dataset so the remaining response count

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was 10,819. Table 4 (p. 37) shows the Response Rates from the Student Questionnaires listed by field.

For the faculty dataset, the committee of the NRC study chose to define faculty as those who had directed doctoral research dissertations within the last five years. “Core” faculty members were those whose primary appointment was in the doctoral program; “New” faculty members were those with tenure track appointments who were appointed in 2003-2006. A distinction was further made and labeled “Allocated Faculty” to prevent over-counting the productivity of faculty who were involved with multiple programs. For this study, the researcher has chosen not to use any data based on “Allocated Faculty” as that figure was based on a formula rather than raw numbers. Lastly, data regarding publications in the scholarly literature were obtained by the Thomson-Reuter list of publications.

Recent National Initiatives

Recently, the problem of doctoral attrition has reached a national audience. In 2007, the Council of Graduate Schools published the first of five monographs titled, “Ph.D. Completion and Attrition”, which provided an analysis of baseline demographic data, findings from exit surveys, and policies and practices to promote student success. The third monograph used self-reported data from Ph.D. completers at 18 participating institutions to examine respondents’ experiences and opinions regarding the following factors and their role in Ph.D. completion: selection/admission processes, availability and quality of mentoring and advising, extent and adequacy of financial support, program environment, curricular processes and procedures, and research experiences. The study reported that the top three main factors that contributed to respondents’ ability to complete were financial support, mentoring/advising, and non-financial family support (Council of Graduate Schools, 2009).

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Other recent national initiatives concerned with doctoral education include the Responsive Ph.D. Project (which seeks to bridge the mismatch between doctoral training and the careers that follow), the Carnegie Initiative on the Doctorate (which was similarly committed to restructuring programs to better fit graduates), and AGEP programs (which aim to increase the number of underrepresented minorities obtaining graduate degrees and better prepare them for faculty positions). The NSF's Doctoral Initiative on Minority Attrition and Completion (DIMAC) is another on-going study which will examine patterns of attrition and completion among underrepresented minorities in the STEM fields. These national initiatives have provided a solid foundation for continuing conversation about the actions required to ensure advancements in doctoral education, and commendably, many institutions are now committed to "reform" efforts in response to the issues uncovered by these reports (Council of Graduate Schools, 2004).

Recommendations for Improving Completion Rates

Universities have also begun making recommendations for improving this national problem of doctoral attrition. A study by the Graduate Center for Research, Writing, and Proposal Development at Western Michigan University (WMU), for example, produced the following recommendations that were disseminated within that university in a top-down fashion (Di Pierro, 2007):

1. Continue to measure outputs in all departments and note trends in time to degree that may protract the process;
2. Develop culturally diverse advising models;
3. Encourage development of the dissertation topic early in the student's doctoral education;
4. Make the dissertation seminar a collaborative enterprise that culminates in a final product – a concept paper or a working draft of the dissertation proposal;

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5. Conduct entry and exit interviews with all students – those who graduate, as well as those who do not complete;
6. Measure completion rates for comprehensive examinations;
7. Focus on recruitment and retention of students from underrepresented groups, especially in the STEM fields;
8. Use process flow charts and accompanying narratives as roadmaps to navigate students through the process;
9. Use a universal tracking document to help tract future data;
10. Develop ongoing orientations for doctoral students that coincide with each phase of doctoral study;
11. Provide training for graduate advising faculty;
12. Develop ongoing orientations for graduate advising faculty to familiarize them with policy changes and to provide them with an open forum through which they can address issues of concern from the faculty perspective.

Sarah Church (2009) examined the relationship between the unique practice of Mock Orals (MO) – a component of a doctoral degree program at a private metropolitan university – and completion. In contrast to the traditional dissertation model, this university prepared doctoral students for their oral-defense presentations by engaging them in bi-annual practice presentations. The audience for the MO included in-progress students, program graduates, guests, university faculty, and professionals (Church, 2009). Data indicated that 88% of matriculated students had been graduated at that university, in comparison to the 50% national average of completion. According to the students in the study, Mock Orals greatly improved their abilities to publicly present their research, cope with and address challenging questions with

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confidence and eloquence, anticipate statistical queries, and demonstrate knowledge of appropriate behaviors during their final Oral Defense.

Another area under investigation is the effects of cognitive-behavioral coaching (CBC) for doctoral students. A 2008 study indicated that CBC participants at an Australian University developed useful skills and felt more positive about their doctoral study (Kearns, H., Gardiner, M. & Marshall, K., 2008). The coaching process involved setting measurable time-specific goals, identifying the obstacles and costs of those barriers to success, creating an action plan, and identifying and challenging negative beliefs.

Lastly, in their fourth monograph, the Council of Graduate Schools (2010) highlighted these promising practices in the following six areas:

- Student Selection and Admissions: offer pre-admission and pre-enrollment campus visits, use early research opportunities as a recruitment tool, improve efforts to recruit underrepresented students, and improve department websites.
- Mentoring and Advising: offer early advising and use external and peer mentors.
- Financial Support: increase student support and link departmental allocations and performance indicators of student completion.
- Program Environment: strengthen support networks and support services and implement family accommodation policies
- Research Experience: offer pre-program research experiences and allow students to engage early in research.
- Curricular and Administrative Processes and Procedures: offer writing assistance for graduate students, offer additional support during the dissertation phase, and assist in professional development.

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Summary of the Literature Review

This researcher used Tinto's Model of Graduate Persistence to organize this chapter, and highlighted articles within the following broad themes: Program orientations and social activities, academic and student support, student characteristics, student finances, faculty research and diversity. The original NRC study and dataset were summarized, and typical program requirements for the five fields in the study were also highlighted. Finally, the chapter concluded with an overview of recent national initiatives and current "best practice" recommendations for improving completion rates in doctoral programs.

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Tables and Figures

Table 2: Total Response Counts and Rates from the Program, Faculty, and Student Questionnaires for the original NRC Study

Questionnaire	*Total Responses*	*Response Rate (%)*
Program	4,838 rated programs	100
Faculty	87,515	88
Student (five fields)	11,888	73

Table 3: NRC Assessment Issues and Related Impacts on Current Study

NRC Issue	*Description*	*Minimized Impact*
Omissions	Some large fields (such as Education and Business) were not included in the study. A reputational measure was not included in the ranking of the programs. Conference papers were not counted as publications.	This study is not generalizing the results to omitted fields; a reputational measure is not a variable of interest in the current study, and none of the programs that place an emphasis on conference papers (i.e. computer science) are included in the present study.
Interdisciplinary issues / faculty allocations	It was difficult to measure the workload of faculty members, whose appointment generally lied in a single department but who participated in more than one graduate program.	Although the researcher believes the NRC committee's handling of this issue was acceptable (the allocations of faculty time by using a formula based on expended "effort" within a program), no variables based on allocated faculty will be used in this study.
Classification errors / ranking-related problems	The taxonomy of fields may not reflect 'ideal' distinctions; there is substantial variability in the names of programs in many fields; the methodologies were illustrative and did not provide a definitive ranking.	The Ph.D. program (rather than the field) is the unit of analysis in the current study; neither illustrative methodology will be used in the study; programs rankings are not of interest in this study.

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Table 3 (Continued)

NRC Issue	*Description*	*Minimized Impact*
Clerical mistakes / possible input errors	Although the NRC committee carried out broad statistical tests, examined outliers, and requested corrections, some errors may remain.	The data from the selected variables in the present study were either self-entered, based on raw numbers, or personal ratings. Thus, the possibility for input errors is largely reduced.

Table 4: Response Rates from Student Questionnaires by Field (NRC)

Field	*Neuroscience*	*Chemical Engineering*	*Physics*	*Economics*	*English*	*Overall*
(Broad Field)	*(Biological and Health Sciences)*	*(Engineering)*	*(Physical and Math Sciences)*	*(Social and Behavioral Sciences)*	*(Humanities)*	
Total Students Surveyed	1,997	2,411	5,250	2,903	3,878	16,439
Total Students Responding	1,562	1,820	3,596	2,067	2,544	11,589
Overall Response Rate (%)	78.2	75.5	68.5	71.2	65.6	70
Number of Students in programs with 10+ responses	1,373	1,538	3,322	1,829	2,354	10,416
Total Programs	94	108	153	116	122	593
Programs with 10+ responses	61	55	106	69	89	380
% of responding students in programs with 10+ responses	87.9	84.5	92.3	88.4	92.5	90
% of programs with 10+ responses	64.8	50.9	69.2	59.4	72.9	64

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CHAPTER THREE

METHODS

Research Design

According to McMillan & Schumacher (2010), secondary data analysis is the process of statistically examining data collected by some other individual(s) at some prior time, and is often selected by researchers because of data quality and increased sample size. For the purposes of this study, a quantitative research design was used to analyze secondary data from the National Research Council's *Assessment of Research Doctorate Programs in the United States*. Specifically, a correlational design was used to examine the relationships between timely doctoral completion rates and 22 variables, and independent t-test / chi-square analyses were used to provide a comparison between high and low completing programs.

The study was designed to answer the following two research questions:

1. What is the relationship between timely doctoral completion rates[5] and the following variables (availability of graduate orientations, number of student support activities, average first year enrollment size, total number of enrolled students, percent of first year students with full financial support, percent of students with teaching assistantships, percent with research assistantships, median time to degree, existence of an annual student review, average GRE score, percent of students that are married, percent of students with dependents, percent of students with mentors, average satisfaction ratings

[5] Within 6 years for programs in Neuroscience, Chemical Engineering, Physics, Economics, or within 8 years for programs in English.

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with program, average sense-of-belonging rating, percent of students that are female, percent that are minorities, percent of faculty with grants, percent of faculty that are female, percent that are minorities, total number of faculty, and faculty to student ratio) in the:

   a. *Neuroscience* field?
   b. *Chemical Engineering* field?
   c. *Physics* field?
   d. *Economics* field?
   e. *English* field?
   f. *All Programs* group from these 5 fields combined?

2. When comparing doctoral programs with high completion rates and those with low completion rates[6], which variables show statistically significant differences in the:

   a. *Neuroscience* field?
   b. *Chemical Engineering* field?
   c. *Physics* field?
   d. *Economics* field?
   e. *English* field?
   f. *All Programs* group from these 5 fields combined?

Population and Sample

The assessment from the National Research Council's 2011 publication provided an unprecedented collection of data on over 5000 doctoral programs at 212 universities in the United States. In November 2006 the chairman of the National Research Council, Ralph

[6] Exact cut-offs for high- and low-completion groups in each field are presented in Table 6 (Chapter 4).

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Cicerone, notified presidents of U.S. universities that the NRC intended to conduct a new assessment of doctoral programs. Two hundred and twelve universities chose to participate. Out of the 5000 programs at those universities, only 380 programs in five fields (Chemical engineering, Physics, Economics, English and Neuroscience) were asked to collect data from their students. As this researcher intended to include data from those student questionnaires, the sample size was ultimately limited to those 380 programs. Out of that set, 15 programs had missing information so the total number of programs in the sample of this study is 365. Total faculty and student responses from those 365 programs were 12,391 and 10,416 respectively. A classification of responses by field is provided in Chapter 4.

Variables

Descriptions and Coding of the Dependent Variable (Average Timely Completion Rates) and the Independent Variables (Program, Student, and Faculty Factors) are listed in Table 5, p. 44.

Instrumentation

During the winter of 2005, a panel of graduate deans and institutional researchers met to review the developed questionnaires for the NRC's study, and to suggest additional or alternative questions. Once the draft questionnaires were posted on the project's website, many universities offered additional suggestions as well. The questionnaires were then finalized in November 2006.

The following five questionnaires were designed and used by the NRC: an institutional questionnaire, a program questionnaire, a faculty questionnaire, a student questionnaire, and a rating questionnaire. The administration of all these questionnaires was conducted by NRC's contractor, Mathematica Policy Research, in close collaboration with the NRC staff. All

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questionnaires were approved by the Institutional Review Board (IRB) of the National Research Council and most institutions also received approval from their own IRBs (Ostriker et. al, 2010).

Although there were five questionnaires that were used for the NRC's purposes, data from only three (the program, faculty and student questionnaires) were used in the current study. The thirty-page Program Questionnaire collected information on faculty (such as rank, tenure status, gender, and race), on students (such as the number enrolled), and on program support (such as graduate orientation availability). The Faculty Questionnaire was a 14-page document consisting of the following nine sections: Program Identification, Prior Experience, Educational Background, Scholarly Activity, Research Activity, Doctoral Students, Program Quality, Demographic Information, and a request for the C.V. to verify publication and career path data. Finally, the Student Questionnaire, which was titled the "Admitted to Candidacy Student Questionnaire", was also a 14-page document and consisted of the following five sections: Education, Post-graduation Plans, Program Characteristics, Resources, and Background Information. All three questionnaires were quantitative and qualitative in nature, and included yes/no questions, multiple-choice questions, and fill-in spaces for numbers and descriptions.

Data Collection Procedures

The following data collection procedure was explained in the *Revised Guide to the Methodology of the Data-Based Research Assessment of Research-Doctorate Programs in the United States (2010):* Each participating university was asked to name an institutional coordinator (IC) who would be responsible for collecting data from the university. On the institutional questionnaire, the IC provided the names of the programs that met the NRC criterion for inclusion. Each of these programs was then sent the program questionnaire through the IC.

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Some universities collected and provided the data centrally. Others distributed the program questionnaires to each of their programs to complete.

The faculty questionnaire was sent to core and new faculty[7] in each program and included a section that asked faculty for their opinion on which aspects of the doctoral program were most important to quality. The illustrative rankings were later based on these faculty responses. Faculty members from programs in five fields (neuroscience, chemical engineering, physics, Economics, and English) were also asked to provide lists of enrolled doctoral candidates. These admitted-to-candidacy students were then each sent a copy of the student questionnaire. All surveys were delivered and answered online (Ostirker et. al, 2010).

Data Validation and Cleaning

The first data cleaning and accuracy check was conducted in 2007, which involved returning the data to all programs with a request that missing data be supplied and that data be checked for accuracy. In February 2008, the NRC conducted 2 sigma (outlier) tests on 14 key variables. Each Institutional Coordinator received spreadsheets and was asked to fill in blanks and to correct or confirm outlier values. During this process, 298 programs confirmed their existing data or submitted changes. In addition to the external checks with the institutions, NRC staff performed ongoing internal checks on the data as well, and flagged any anomalies or missing cells. This verification process was ongoing through the Summer 2010, and universities were able to send in corrections until November 2010.

Data Analysis

Analysis of the data for this researcher's study was completed using SPSS Software. Descriptive statistics, including means, standard deviations and ranges are reported for all

[7] "Core" faculty members were those whose primary appointment was in the doctoral program; "New" faculty members were those with tenure track appointments who were appointed in 2003-2006.

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variables in this study. To assess multicollinearity, the researcher examined Pearson Correlation Coefficients and Variance Inflation Factors. Inferential tests were then conducted to address each research question. For the first research question, multiple regression analysis was used to formulate regression equations to show (1) the relationship between Program, Student, and Faculty Variables and timely completion rates in each field, (2) the size of that relationship, and (3) the contribution of each variable to that relationship. The researcher conducted six separate multiple regressions – one for each field and an additional one for all the programs in the dataset. For the second research question, independent t-tests and chi-squares were conducted to compare high completion-rate programs with low completion-rate programs on all 22 factors for each of the five fields.

Summary

Utilizing secondary data, this study is measuring the relationship between timely doctoral completion rates and 22 variables within programs from the following 5 fields: Neuroscience, Chemical Engineering, Physics, Economics and English. The study is also comparing high and low completing programs across multiple variables in each field. The population was described and consists of 365 programs, 12,391 faculty responses and 10,416 student responses. Three of the five questionnaires – the Program Questionnaire, the Faculty Questionnaire, and the Admitted-to-Candidacy Student Questionnaire – from the NRC's Assessment instrument were utilized in the present study. Finally, data collection procedures and data analysis techniques were also explained.

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Tables and Figures

Table 5: Variable Descriptions & Coding

Variable	*Description*	*Coding*
***Dependent Variable*: Average Completion Rate (within 6 years in Neuroscience, Chemical Engineering, Physics and Economics, or within 8 years in English)**	To compute the completion rate, the number of doctoral students for a given entering cohort (from 1996-1997 to 2005-2006) who completed their doctorate within the specified time frames was divided by the total number of entering students in that cohort. This computation was made for each cohort that entered from 1996-1997 to 1998-1999 for English, and 1996-1997 to 2000-2001 for the other 4 fields. To compute the average completion rate, an average was taken over 3 cohorts in English and over 5 cohorts for the other fields.	Percentage ranging from 0-100%
Independent Variables (Program Variables):		
Availability of Graduate Orientations	This variable indicates whether orientation for new graduate students was provided for by the program.	A Graduate Orientation was: (1) provided by the program (0) not provided by the program
Number of Student Support Activities (Max 18)	This variable is the count of student support activities provided by the program or the institution. The list of activities used for this variable can be reviewed in the Program Questionnaire (Appendix A).	Continuous variable ranging from 0-18 activities
Average Annual First Year Enrollment Size	An average was taken over 5 years of the number of first-time enrolled students (for 2001-2002, 2002-2003, 2003-2004, 2004-2005, and 2005-2006).	Continuous variable
Total Enrollment Size	Number of Students enrolled in the program (Fall 2005)	Continuous variable
Percent with Full Financial Support, Fall 2005	The number of full-time first-year graduate students who received full financial support during the fall 2005 term was divided by the total number of full-time, first-year doctoral students enrolled during the fall 2005 term.	Percentage ranging from 0-100%

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Table 5 (continued)

Variable	*Description*	*Coding*
Percent with Teaching Assistantships	The number of students with Teaching Assistantships, fall 2005 as a percent of enrollment.	Percentage ranging from 0-100%
Percent with Research Assistantships	The number of students with Research Assistantships, fall 2005 as a percent of enrollment.	Percentage ranging from 0-100%
Median Time to Degree	The median time to degree for full-time and part-time students averaged over the years 2004-2006.	Continuous variable
Existence of an Annual Student Review	This variable reports if the program performs an annual review of its enrolled doctoral students	Does the program perform an annual review: (1) Yes (0) No
(Student Variables):		
Average GRE Scores, 2004-2006	A weighted average was used to compute the average GRE scores, which was calculated by multiplying the number of individuals reporting scores by the reported average GRE score for the 2003-2004, 2004-2005, and 2005-2006 academic years, adding these three quantities and dividing by the sum of the individuals reporting scores.	Continuous Variable
Percent Married	The number of married students divided by the total number of students who completed the Student Questionnaire in each program.	Percentage ranging from 0-100%
Percent with Kids	The number of students with dependents divided by the total number of students who completed the Student Questionnaire in each program.	Percentage ranging from 0-100%
Percent with Mentors	The percent of students with a mentor either inside or outside the program.	Percentage ranging from 0-100%
Average Sense of Belonging	The average sense of belonging to a program.	Average rating per program based on the following scale[8]: (1) A lot (2) Some (3) Not at all

[8] This rating scale was used in the Student Questionnaire from the NRC study.

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Table 5 (continued)

Variable	*Description*	*Coding*
Average Satisfaction with Program	The average satisfaction rating of students in each program with the overall quality of their specific program.	Average rating per program based on the following scale[9]: (1) Very Satisfied (2) Somewhat Satisfied (3) Not Satisfied
Percent of Female Students, Fall 2005	This variable is the number of female graduate students divided by the total number of doctoral students	Percentage ranging from 0-100%
Percent of Minority Students, Fall 2005	This variable is the number of non-Hispanic Blacks, Hispanics, and American Indians or Alaska Natives divided by the total of students with known race/ethnicity.	Percentage ranging from 0-100%
(Faculty Variables):		
Percent of Faculty with Grants, 2006	The total number of faculty in 2006 who answered that their work was "currently being supported by an extramural grant or contract" was divided by the total respondents in the program.	Percentage ranging from 0-100%
Percent of Female Faculty	The ratio of female faculty to the total number of faculty.	Percentage ranging from 0-100%
Percent of Minority Faculty	The ratio of non-Hispanic Black, Hispanic, and American Indian or Alaska Native faculty to that of all faculty members with known race/ethnicity	Percentage ranging from 0-100%
Number of Faculty	Total number of core and new faculty.[10]	Continuous variable
Faculty to Student Ratio	The number of faculty divided by the total number of enrolled students	Faculty: Student Ratio

[9] This rating scale was used in the Student Questionnaire from the NRC study.

[10] "Core" faculty members were those whose primary appointment was in the doctoral program; "New" faculty members were those with tenure track appointments who were appointed in 2003-2006.

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CHAPTER FOUR

RESULTS

Introduction

This chapter provides the results of the analyses conducted in the completion of the study. Specifically, this chapter presents the multicollinearity of the independent variables, the model summaries of the multiple regression analyses, the standardized coefficients and effect sizes of the significant variables from the regressions, and the effect sizes of the variables with significant t-test or chi-square differences.

The first two purposes of this study was to determine which *Program*, *Student*, and *Faculty* variables were significant predictors for timely completion rates in selected doctoral programs, and to determine how much of the variance in completion rates could be explained by measurable data. The 22 predictive variables used in the study were:

- Availability of Graduate Orientations (Orient)
- Number of Student Support Activities (#Activities)
- Average First Year Enrollment Size (1st Yr Size)
- Total Number of Enrolled Students (#Enrolled)
- Percent of First Year Students with Full Financial Support (%Financed)
- Percent of Students that are Teaching Assistants (%TA)
- Percent of Students that are Research Assistants (%RA)
- Median Time to Degree (TTD)
- Existence of an Annual Student Review (AnRev)

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- Average GRE Score (GRE)
- Percent of Students that are Married (%Married)
- Percent of Students with Dependents (%wKids)
- Percent of Students with Mentors (%wMentors)
- Average Satisfaction Ratings with Program (Satisfaction)
- Average Sense of Belonging Ratings (Belonging)
- Percent of Students that are Female (%FemStud)
- Percent of Students that are Minorities (%MinStud)
- Percent of Faculty with Grants (%FacGrants)
- Percent of Faculty that are Female (%FemFac)
- Percent of Faculty that are Minorities (%MinFac)
- Total Number of Faculty (#Faculty)
- Faculty to Student Ratio (Ratio)

The third purpose of the study was to present comparisons between high-completing programs and low-completing programs across the 22 variables. Since the average completion rate varied considerably by field, the cut-offs that separated high-completing programs from low-completing programs were also different for each field. The researcher used the average completion rate in each field ± 10 percentage points to determine the high- and low-completing groups (See Table 6, p. 60).

Descriptive Statistics

The program, faculty and student sample sizes, average completion rates, and standard deviations of all programs are listed in Table 7, p.60. The lowest and highest average completion rate in each field are also listed in the table.

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The field of Physics had the highest number of programs in the study (100) and the Chemical Engineering field had the lowest (55). Average completion rates varied from 35.2% (Physics) to 59.5% (Chemical Engineering), and a comparison of the completion rates by field can be seen in Figure 2, p. 75.

The descriptive statistics (means, standard deviations, and ranges) of each variable are listed for each field in Appendices D through I, and a side-by-side comparison of means across all the fields is provided in Table 8, p. 61.

Multi-Collinearity Tests

Prior to completing the multiple regression analysis, the researcher checked to see if the assumption of no multicollinearity had been met. Pearson correlations were calculated between the 22 predictive variables for all programs, and again for each of the five fields. For the *Economics*, *English*, and *All Programs* groups, two variables (1st year size and the number of enrolled students) were correlated beyond the .80 threshold. The researcher chose to exclude the # Enrolled Students variable as previous research has shown that 1st year size generally has a stronger relationship with completion rates. For the *Neuroscience*, *Chemical Engineering*, and *Physics groups*, three variables (1st year size, number of enrolled students, and number of faculty) were correlated beyond the .80 threshold. The researcher again chose to keep the 1st year size variable and exclude the other two. After removing the specified correlated variables, the variance inflation factors showed that the remaining variables were no longer unduly influencing each other as the VIFs were well below 10.

Research Question One: Multiple Regression Results

The first purpose of the study was to determine which factors contributed the most to predicted timely completion rates in Neuroscience, Chemical Engineering, Physics, Economics

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and English. Thus, a multiple regression analysis was conducted for programs in each field. An additional multiple regression analysis was performed on all the programs in the dataset to observe relationships between the 22 variables and timely completion rates regardless of field. To assess normality of the residuals, the researcher looked at histograms and residual p-plots. Those plots indicated that the assumptions of linearity and homoscedasticity had been met for each regression line. Appendices J through O show the plots of the standardized residuals versus the standardized predicted values for each field and for all the programs in the dataset.

The first research question in the study was:

1. What is the relationship between timely doctoral completion rates[11] and the following variables (availability of graduate orientations, number of student support activities, average first year enrollment size, total number of enrolled students, percent of first year students with full financial support, percent of students with teaching assistantships, percent with research assistantships, median time to degree, existence of an annual student review, average GRE score, percent of students that are married, percent of students with dependents, percent of students with mentors, average satisfaction ratings with program, average sense-of-belonging rating, percent of students that are female, percent that are minorities, percent of faculty with grants, percent of faculty that are female, percent that are minorities, total number of faculty, and faculty to student ratio) in the:
    a. *Neuroscience* field?
    b. *Chemical Engineering* field?
    c. *Physics* field?

[11] Within 6 years for programs in Neuroscience, Chemical Engineering and Economics, or within 8 years for programs in English.

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d. *Economics* field?

e. *English* field?

f. *All Programs* group from these 5 fields combined?

Research Question 1a: In Neuroscience (*n*=58), the relationship between timely doctoral completion rates and each of the 22 variables can be seen in the model summary below:

-40.368 – 8.396 (Satisfaction) + 18.245 (Belonging) -5.171(%wMentor) + 13.127 (%Married) -4.501 (%wKids) + .196 (%FacGrants) + **1.160 (%Financed)** -.850 (MinFac) + **.581 (%FemFac) +** .009 (GRE) + 1.730 (#Activities) + -.515 (1st Year Size) + .090 (%FemStud) **-16.332 (TTD)** -.245 (%MinStud) -2.710 (%RA) -34.063 (%TA) -8.558 (Ratio) + 4.679 (Orient) -4.729 (AnRev)

This model summary produced F (20,37) = 3.660, $p \leq .05$, and explained 66.4% of the variance in the average completion rate in *Neuroscience* programs. Thus, 66.4% of the timely completion rates from the *Neuroscience* dataset were predicted accurately by using this model formula. In terms of relationships, all the positive numbers in the formula indicate positive relationships with completion rates, and the negative numbers indicate negative relationships. Thus after controlling for other variables in Neuroscience, completion rates increase as the percentage of students with full finance and the percentage of female faculty increase, whereas completion rates *decrease* when the median time to degree increases. This researcher also analyzed standardized beta weights to identify the contribution that each of the significant variables has in predicting the dependent variable: Time to degree has the strongest relationship with the dependent variable (as evidenced by the standardized regression coefficients), followed by the percentage of students with full financing, and then female faculty. Table 9 (p. 62) shows the un-standardized and standardized coefficients of each variable in the *Neuroscience* field, and the three significant variables are highlighted in bold.

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Research Question 1b*:* In Chemical Engineering (*n*=55), the relationship between timely doctoral completion rates and each of the 22 variables can be seen in the model summary below:

2.224 -.458 (Satisfaction) -13.290 (Belonging) + 24.837 (%wMentor) -5.615 (%Married) -34.457 (%wKids) -.253 (%FacGrants) -.395 (%Financed) + **.759 (%MinFac)** -.020 (%FemFac) + .074 (GRE) **+ 2.353 (#Activities) + .892 (1st Year Size)** + .421(%FemStud) + .822 (TTD) + .033 (%MinStud) + 5.066 (%RA) + 17.044 (%TA) + 5.191 (Ratio) -2.883(Orient) -7.297 (AnRev)

This model summary produced F (20,34) = 2.472, $p \leq .05$ with a R^2 value of 59.3%. Thus, 59.3% of the completion rates were accurately predicted by using this formula in Chemical Engineering. All three significant variables (Percentage of Minority Faculty, Number of Support Activities and 1st year size) had positive relationships with completion rates. Table 10 (p. 63) shows the un-standardized and standardized coefficients of each variable in the *Chemical Engineering* field, and the significant variables are again highlighted in bold. In Chemical Engineering, First Year Size has the strongest relationship with timely completion rates, followed by Minority Faculty, and then Number of Activities.

Research Question 1c*:* In Physics (*n*=100), the relationship between timely doctoral completion rates and each of the 22 variables can be seen in the model summary below:

32.749 -6.607 (Satisfaction) + 2.244 (Belonging) -20.403 (%wMentor) + 3.716 (%Married) + 1.343 (%wKids) -.022 (%FacGrants) + .016 (%Financed) + .157 (%MinFac) **-.401 (%FemFac) + .121 (GRE)** -.562 (#Activities) -.040 (1st Yr Size) -.063 (%FemStud) **-10.346 (TTD)** -.157 (%MinStud) + 7.275 (%RA) -8.916 (%TA) + 5.918 (Ratio) + 4.670 (Orient) +2.826 (AnRev)

This summary produced F (20,79) = 6.360, $p \leq .001$ with a R^2 value of 61.7%. For this field, 61.7% of the completion rates in the dataset were predicted accurately by using this formula. The

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percentage of female faculty and the median time to degree have negative relationships with completion rates, whereas GRE score has a positive relationship. Table 11 (p. 64) shows the un-standardized and standardized coefficients of each variable in the *Physics* field, and the significant variables are again highlighted in bold. Standardized beta weights show that the median Time to Degree has the strongest relationship with timely completion rates, followed by the percentage of Female Faculty, and then GRE score.

Research Question 1d*:* In Economics (*n*=64), the relationship between timely doctoral completion rates and each of the 22 variables can be seen in the model summary below:

> **204.091**-5.242 (Satisfaction) **-29.857 (Belonging) -64.456 (%wMentor)** -6.388 (%Married) -8.980 (%wKids) + .155 (%FacGrants) + **.161 (%Financed) -.683 (%MinFac) +** .081 (%FemFac) -.018 (GRE) **+ 2.092 (#Activities)** -.099 (1st Yr Size) **-.524 (%FemStud) -8.913 (TTD)** -.007 (%MinStud) + .138 (#Faculty) -15.813 (%RA) **-20.551 (%TA) +** 9.225 (Ratio) -11.228 (Orient) -5.400 (AnRev)

This summary produced F (21,42) = 8.014, $p \leq .001$. The R^2 value was 80.0%, which shows that 80.0% of the completion rates in the *Economics* dataset were predicted accurately by this model. Table 12 (p. 65) shows the un-standardized and standardized coefficients of each variable in the *Economics* field, and the significant variables are highlighted in bold. Standardized beta weights show that the Percentage of Students with Mentors has the strongest relationship with timely completion rates in Economics, followed by Time to Degree, then Belonging, % Female Students, % Teaching Assistants, Number of Activities, % Financed, and then Minority Faculty. All of the significant variables have negative relationships with completion rates in the Economics field except for percentage of students with full financing and number of activities.

Research Question 1e*:* In English (*n*=88), the relationship between timely doctoral completion rates and each of the 22 variables can be seen in the model summary below:

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-46.746 + 3.839 (Satisfaction) -14.018 (Belonging) + .294 (%wMentor) + 13.438 (%Married) + 4.721 (%wKids) -.308 (%FacGrants) + .106 (%Financed) + .438 (%MinFac) -.457 (%FemFac) + **.145 (GRE)** + 1.783 (#Activities) + **2.051 (1st Yr Size)** -.020 (%FemStud) - 2.688 (TTD) -.248 (%MinStud) **-.723 (#Faculty)** -19.100 (%RA) + 7.186 (%TA) + **31.009 (Ratio)** + .961 (Orient) -6.306 (AnRev)

This model summary produced F (21, 66) = 2.076, $p \leq .05$ with a R^2 value of 39.8%. Table 13 (p. 66) shows the un-standardized and standardized coefficients of each variable in the *English* field, and the four significant variables are highlighted in bold. First year size has the strongest relationship with timely completion rates in English, followed by the number of faculty, faculty to student ratio, and then GRE. All of the significant variables have positive relationships with completion rates except for the number of faculty.

Research Question 1f*:* Finally, the relationship between timely doctoral completion rates and each of the 22 variables from *All the Programs* in the dataset (n=365) can be seen in the model summary below:

101.156 -12.473 (Satisfaction) - 4.013 (Belonging) - 15.958 (%wMentor) + .268 (%Married) - 5.990 (%wKids) **- .109 (%FacGrants) + .191 (%Financed)** + .067 (%MinFac) +.138 (%FemFac) - .027 (GRE) **+ 1.242 (#Activities) + .564 (1st Year Size)** + .089 (%FemStud) **– 5.836 (TTD)** - .036 (%MinStud) **- .180 (#Faculty)** + 2.343 (%RA) **– 12.582 (%TA)** + 3.643 (Ratio) + 5.753(Orient) **– 5.671 (AnRev)**

This model summary produced F (21,343) = 7.540, $p \leq .001$ with a R^2 value of 31.6%. In other words, 31.6% of the completion rates from the data set were accurately predicted in the *All Programs* group by using this formula. The percentage of students with full financial support, the

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number of activities, the overall satisfaction rating[12], and 1st year size were positively related to timely completion rates. The remaining significant variables (percentage of faculty with grants, median time to degree, number of faculty, percentage of teaching assistants, and existence of an annual review) had negative relationships. Table 14 (p. 67) shows the un-standardized and standardized coefficients of each variable in the model, and the significant variables are highlighted in bold. Standardized beta weights revealed that time to degree has the strongest relationship with the dependent variable, followed by 1st year Size, Percentage of Faculty with Grants, Percentage of students with Full Financial Support, Percentage of Teaching Assistants, Number of Faculty, Satisfaction Ratings, and then Number of Activities.

In summary of all six multiple regression analyses, Table 15 (p. 68) shows the effect degrees of freedom (*df*1), the residual degrees of freedom (*df*2), *F*-values and related significance, the R^2 and Adjusted R^2 values, as well as the standard error estimates.
All the models were significant at the $p<.05$ level. Plus, in fulfillment of the second purpose of the study, the R^2 values were determined for each field and revealed that:

- 66.4% of the variance in timely completion rates was accounted for by the variables in *Neuroscience*.
- 59.3% of the variance was accounted for by the variables in *Chemical Engineering*.
- 61.7% of the variance was accounted for by the variables in *Physics*.
- 80.0% of the variance was accounted for by the variables in *Economics*.
- 39.8% of the variance was accounted for by the variables in *English*, and
- 31.6% of the variance was accounted for by the variables in the *All Programs* group.

[12] Although the variable Satisfaction has a negative coefficient, the relationship should be considered positive since the ratings were scaled inversely: (1) Very Satisfied (2) Somewhat Satisfied and (3) Not Satisfied.

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Research Question Two: Independent T-Test / Chi-Square Results

The third purpose of this study was to present comparisons between high-completing programs and low-completing programs across the 22 variables. Thus, independent *t*-tests (or chi-square tests for categorical variables) were conducted on each variable for each of the five fields, and again for all the programs in the dataset. To determine if the equal-variances assumption had been met, the researcher used Levene's test. In order to assess if effect sizes were large, medium, or small, the researcher used Cohen's *d* for continuous variables and Cramer's *v* for the two categorical variables.[13] The second research question in the study was:

2. When comparing doctoral programs with high completion rates and those with low completion rates[14], which variables show statistically significant differences in the:
    a. *Neuroscience* field?
    b. *Chemical Engineering* field?
    c. *Physics* field?
    d. *Economics* field?
    e. *English* field?
    f. *All Programs* group from these 5 fields combined?

An independent t-test (or chi-square test for the 2 categorical variables, specifically Orientation and Annual Review) was used to compare the differences in average completion rates between high-completing and low-completing programs in each of the five fields. The researcher used the mean of each field's average completion rate (Neuroscience =44.1%,

[13] The following scale is generally used to interpret effect sizes from Cohen's *d*: 0.2= small, 0.5= medium, and 0.8=large. Effect sizes from Cramer's *v* are generally interpreted as: 0.1= small, 0.3= medium, and 0.5=large.
[14] Exact cut-offs for high- and low-completion groups in each field are presented in Table 6 (Chapter 4).

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Chemical Engineering= 59.5%, Physics= 35.2%, Economics= 41.2%, and English= 47.6) ± 10 percentage points to determine the cut-offs for each field's Low- and High-Completion groups.

Research Question 2a: In *Neuroscience*, there was one statistically significant difference between the "Low-Completion Group" (n=21) and the "High Completion Group" (n=16): Time To Degree (t (35)=4.2, p<.05). Table 16 (p. 69) shows the means of each variable for the low- and the high-completing groups in the Neuroscience field. The t or χ^2 value, significance, and effect size are also listed, and the one significant factor (Time to Degree) is highlighted in bold. According to Cohen's d, Time to Degree (d=1.42) had a large effect size.

Research Question 2b*:* In *Chemical Engineering*, there were three statistically significant differences between the "Low Group" (n=14) and the "High Group" (n=13): 1st Year Size (t (19)= -2.713, p<.05), number of faculty (t (17)= -2.192, p<.05), and number of enrolled students (t (16)= -2.482, p<.05). Table 17 (p. 70) shows both group's means, t or χ^2 values, p-values, and effect sizes for each variable. The three significant factors are highlighted in bold, and all three have large effect sizes (d > .8).

Research Question 2c*:* In *Physics*, there were six statistically significant differences between the "Low Group" (n=26) and the "High Group" (n=23): %wKids (t (47)=2.998, p<.05), GRE (t (47)= -2.085), 1st Year Size (t (34)= -2.288, p<.05), TTD (t (47)=5.496, p<.05), #Faculty (t (30)= -2.366, p<.05), and #Enrolled (t (30)= -2.258, p<.05). Table 18 (p. 71) shows the means of the low- and the high-completing groups from the Physics field, and all of the significant factors are again highlighted in bold. The table also shows the t or χ^2 value, significance, and effect size for each variable. GRE (d =-.60), 1st year size (d =-.66), #Faculty (d = -.69), and #Enrolled (d = -.66) have medium effect sizes; %wKids (d = .87) and TTD (d = 1.59) have large effect sizes.

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Research Question 2d*:* In *Economics*, there were statistically significant differences between the "Low Group" (*n*=19) and the "High Group" (*n*=18) for the following nine variables: Satisfaction (*t* (35)=3.341, *p*<.05), Belonging (*t* (26)=2.176, *p*<.05), %FacGrants (*t* (35)=-2.177, *p*<.05), %FemStud (*t* (35)=5.204, *p*<.05), %MinStud (*t* (35)=2.325, *p*<.05), #Faculty (*t* (35)= -3.815, *p*<.05), %RA (*t* (25)=2.559, *p*<.05), %TA (*t* (34)=4.160, *p*<.05), and Ratio (*t* (21)= -2.162, *p*<.05). Table 19 (p. 72) shows both groups' means, *t* or χ^2 values, *p*-values, and effect sizes for each variable. All of the significant factors are highlighted in bold, and all had relatively large effect sizes according to Cohen's *d*: Belonging (*d* = .72), Satisfaction (*d* = 1.09), %FacGrants (*d* = -.72), %FemStud (*d* = 1.71), %MinStud (*d* = .76), #Faculty (*d* =-1.26), %RA (*d* = .85), %TA (*d* = 1.36), and Ratio (*d* = -.70).

Research Question 2e*:* In *English*, there was one statistically significant difference: Time To Degree (*t* (51)=2.886, *p*<.05) between the "Low-Completion Group" (*n*=26) and the "High Completion Group" (*n*=27), which had a large effect size (*d* =.79). Table 20 (p. 73) shows the means of the low- and the high-completing groups from the English field, as well as the *t* or χ^2 values, significance, and effect sizes. The one significant factor is again highlighted in bold.

Research Question 2f*:* Finally, an independent samples *t*-test or chi-square test was used to compare the differences in average completion rates between all 116 low-completing programs and all 102 high-completing programs from the dataset. Using the average timely completion rate of all the programs (44.3%), programs with 0%-34.3% completion rates were labeled "Low-Completion Group" and programs with 54.3%-100% completion rates were labeled "High-Completion Group". There were statistically significant differences between the two groups for the following seven variables: Satisfaction (*t* (214)=3.793, *p*≤.05), %wKids (*t* (216)=2.023, *p*≤.05), %Financed (*t* (202)=-2.481, *p*≤.05), #Activities (*t* (187)=-3.808, *p*≤.05),

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Time To Degree (t (216)=5.585, $p \leq .05$), %TA (t (216)=4.052, $p \leq .05$), and Orient, ($\chi^2(1)=10.031$, $p \leq .05$). Table 21 (p. 74) shows the means of the low- and the high-completing groups from all the programs, and all significant factors are highlighted in bold. The t or χ^2 values, significance, and effect sizes for significant variables are also listed. The researcher used Cohen's d (or Cramer's v for the categorical variables) to assess the effect sizes of each significant difference: %wKids (d = .28) and %Financed (d =-.33) had relatively small effect sizes; Satisfaction (d =.51), %TA (d =.55), and Orient (v = .215) had medium effect sizes; #Activities (d = 1.13) and Time To Degree (d = .76) had large effect sizes.

Summary

This chapter reviewed the research questions and the three purposes of the study, and presented the results of the data analysis from the multiple regression, independent t- and chi-square analyses. Pearson correlations and Variance Inflation Factors were also examined to check for multi-collinearity, and Levene's test was used to check for equal variances. The multiple regression analyses examined which factors had the strongest relationships to timely completion rates in selected doctoral programs. Six model summaries were then presented – one for each of the five fields plus one for all the programs in the dataset – and the relative contributions of each of the 22 independent variables were also noted. Finally, independent t-test and chi-square analyses were conducted to compare the average timely completion rates between low- and high-completing groups in each field as well as in the *All Programs* group. The t-test and chi-square results showed which variables were significantly different between the two groups in all six models, and the effect sizes of the significant variables were also noted.

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Tables and Figures

Table 6: Sample Sizes and Cut-Offs for the High and Low Completion-Rate Groups by Field

	Sample Size: # of Programs in Low Group	*Sample Size: # of Programs in High Group*	*Average Completion Rates*	*Cut-Offs: Low Group*	*Cut-Offs: High Group*
Neuroscience	21	16	44.1%	0% - 34.1%	54.1% - 100%
Chemical Engineering	14	13	59.5%	0% - 49.5%	69.5% - 100%
Physics	26	23	35.2%	0% - 25.2%	45.2% - 100%
Economics	19	18	41.2%	0% - 31.2%	51.2% - 100%
English	26	27	47.6%	0% - 37.6%	57.6% - 100%
All Programs	116	102	44.3%	0% - 34.3%	54.3% - 100%

Table 7: Descriptive Statistics by Field

	N Programs	*N Students*	*N Faculty*	*Average Completion Rates*	*Standard Deviations (SD)*	*Lowest Average Completion Rate*	*Highest Average Completion Rate*
Neuroscience	58	1,373	2,553	44.1%	16.8%	0%	76.6%
Chemical Engineering	55	1,538	972	59.5%	14.4%	12.5%	92%
Physics	100	3,322	3,649	35.2%	13.7%	5%	71.6%
Economics	64	1,829	1,877	41.2%	17.9%	0%	81.8%
English	88	2,354	3,340	47.6%	18.4%	0%	100%
All Programs	365	10,416	12,391	44.3%	18.0%	0%	100%

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Table 8: Variable Means for Each Field

	Neuroscience	*Chemical Engineering*	*Physics*	*Economics*	*English*	*All Programs*
Satisfaction	1.5390	1.5390	1.6210	1.6598	1.5731	1.590858
Belonging	1.5471	1.4511	1.5461	1.6043	1.7175	1.583465
%wMentor	.9289	.8074	.8377	.8218	.9010	.860106
%Married	.3370	.4017	.4249	.4520	.4730	.423793
%wKids	.1446	.1821	.1834	.1977	.2551	.196849
%FacGrants	90.5220	86.3646	83.0313	40.8021	9.2540	59.532%
%Financed	98.5266	97.6859	96.6919	75.3358	85.7997	90.763%
%MinFac	3.1211	5.6071	3.6163	4.8228	9.1991	5.395%
%FemFac	24.5493	11.9491	9.2658	16.0057	46.0013	22.137%
GRE	715.3407	769.3201	766.3697	772.6621	647.1168	731.05750
#Activities	16.6552	16.2909	16.0000	16.2500	16.2273	16.25
1st year size	9.2575	13.3491	17.3177	17.4630	13.0508	14.436
%FemStud	51.2266	29.5729	19.5328	34.6901	61.0195	38.742%
TTD	5.8408	5.0146	5.9544	5.6282	6.9867	5.986
%MinStud	11.6500	10.4057	6.9349	8.7579	10.2431	9.324%
#Faculty	44.0172	17.6727	36.1287	29.3281	37.9545	33.86
#Enrolled	50.7069	62.0909	88.2574	76.7656	79.3409	74.22
%RA	.2931	.4743	.3697	.0919	.0149	.239025
%TA	.0346	.0954	.3325	.3441	.4655	.283536
Ratio	.9499	.3466	.4563	.5047	.5390	.5466
Orient	.8276	.8909	.7600	.8750	.9091	.8466
AnRev	.8966	.3818	.7800	.6563	.5909	.6712

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Table 9: Multiple Regression Results for Neuroscience (*n*=58)

	Coefficients						
Model: *Neuroscience*	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Correlations	
	B	Std. Error	Beta			Zero-order	Part
(Constant)	-40.368	74.211		-.544	.590		
Satisfaction	-8.396	9.765	-.111	-.860	.395	-.036	-.082
Belonging	18.245	11.139	.227	1.638	.110	-.155	.156
%wMentor	-5.171	32.693	-.022	-.158	.875	-.013	-.015
%Married	13.127	17.833	.096	.736	.466	.018	.070
%wKids	-4.501	23.078	-.024	-.195	.846	.153	-.019
%FacGrants	.196	.249	.099	.786	.437	.151	.075
%Financed	**1.160**	**.340**	**.410**	**3.410**	**.002**	**.329**	**.325**
%MinFac	-.850	.507	-.195	-1.678	.102	-.161	-.160
%FemFac	**.581**	**.237**	**.296**	**2.450**	**.019**	**.213**	**.233**
GRE	.009	.061	.023	.148	.883	.044	.014
#Activities	1.730	1.223	.181	1.415	.165	.188	.135
1styrsize	-.515	.496	-.140	-1.038	.306	.034	-.099
%FemStud	.090	.187	.058	.482	.633	-.004	.046
TTD	**-16.332**	**3.209**	**-.551**	**-5.089**	**.000**	**-.601**	**-.485**
%MinStud	-.245	.258	-.118	-.953	.347	.155	-.091
%RA	-2.710	7.836	-.043	-.346	.731	-.072	-.033
%TA	-34.063	18.723	-.209	-1.819	.077	-.243	-.173
Ratio	-8.558	4.837	-.230	-1.769	.085	-.181	-.169
Orient	4.679	6.523	.079	.717	.478	.200	.068
AnRev	-4.729	8.006	-.063	-.591	.558	.021	-.056

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Table 10: Multiple Regression Results for Chemical Engineering (*n*=55)

	Coefficients						
Model: *Chemical Engineering*	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Correlations	
	B	Std. Error	Beta			Zero-order	Part
(Constant)	2.224	118.905		.019	.985		
Satisfaction	-.458	17.184	-.007	-.027	.979	-.286	-.003
Belonging	-13.290	18.351	-.154	-.724	.474	-.197	-.079
%wMentor	24.837	18.695	.235	1.328	.193	.176	.145
%Married	-5.615	18.939	-.066	-.297	.769	-.040	-.032
%wKids	-34.457	28.914	-.267	-1.192	.242	-.310	-.130
%FacGrants	-.253	.199	-.219	-1.273	.212	-.144	-.139
%Financed	-.395	.219	-.238	-1.804	.080	-.088	-.198
%MinFac	**.759**	**.317**	**.300**	**2.392**	**.022**	**.230**	**.262**
%FemFac	-.020	.308	-.010	-.066	.948	.112	-.007
GRE	.074	.124	.117	.600	.553	.151	.066
#Activities	**2.353**	**1.131**	**.294**	**2.081**	**.045**	**.324**	**.228**
1styrsize	**.892**	**.318**	**.468**	**2.806**	**.008**	**.427**	**.307**
%FemStud	.421	.240	.241	1.753	.089	.019	.192
TTD	.822	2.851	.042	.288	.775	-.089	.032
%MinStud	.033	.236	.022	.140	.889	-.131	.015
%RA	5.066	7.876	.092	.643	.524	.207	.070
%TA	17.044	13.345	.209	1.277	.210	-.059	.140
Ratio	5.191	17.874	.063	.290	.773	-.227	.032
Orient	-2.883	9.258	-.046	-.311	.757	.051	-.034
AnRev	-7.297	4.541	-.236	-1.607	.117	-.054	-.176

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Table 11: Multiple Regression Results for Physics (*n*=100)

	Coefficients						
Model: *Physics*	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Correlations	
	B	Std. Error	Beta			Zero-order	Part
(Constant)	32.749	44.266		.740	.462		
Satisfaction	-6.607	6.366	-.098	-1.038	.302	-.160	-.072
Belonging	2.244	8.441	.030	.266	.791	.152	.019
%wMentor	-20.403	14.480	-.133	-1.409	.163	-.216	-.098
%Married	3.716	8.359	.041	.445	.658	-.159	.031
%wKids	1.343	10.809	.014	.124	.901	-.377	.009
%FacGrants	-.022	.120	-.016	-.185	.854	.144	-.013
%Financed	.016	.149	.009	.111	.912	.164	.008
%MinFac	.157	.215	.060	.729	.468	-.082	.051
%FemFac	**-.401**	**.122**	**-.243**	**-3.283**	**.002**	**-.192**	**-.229**
GRE	**.121**	**.047**	**.236**	**2.595**	**.011**	**.225**	**.181**
#Activities	-.562	.561	-.086	-1.002	.319	.191	-.070
1styrsize	-.040	.146	-.027	-.277	.783	.206	-.019
%FemStud	-.063	.185	-.029	-.341	.734	.070	-.024
TTD	**-10.346**	**1.395**	**-.661**	**-7.415**	**.000**	**-.623**	**-.516**
%MinStud	-.157	.157	-.081	-.996	.322	-.180	-.069
%RA	7.275	5.356	.111	1.358	.178	.247	.095
%TA	-8.916	5.545	-.140	-1.608	.112	-.191	-.112
Ratio	5.918	5.991	.087	.988	.326	-.041	.069
Orient	4.670	3.465	.111	1.348	.182	.199	.094
AnRev	2.826	3.643	.065	.776	.440	.164	.054

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Table 12: Multiple Regression Results for Economics (*n*=64)

Coefficients							
Model: *Economics*	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Correlations	
	B	Std. Error	Beta			Zero-order	Part
(Constant)	**204.091**	**53.706**		**3.8**	**.000**		
Satisfaction	-5.242	8.881	-.076	-.590	.558	-.450	-.041
Belonging[15]	**-29.857**	**11.627**	**-.330**	**-2.568**	**.014**	**-.319**	**-.177**
%wMentor	**-64.456**	**19.597**	**-.370**	**-3.289**	**.002**	**.039**	**-.227**
%Married	-6.388	11.473	-.060	-.557	.581	-.114	-.038
%wKids	-8.980	16.570	-.060	-.542	.591	-.235	-.037
%FacGrants	.155	.090	.153	1.733	.090	.246	.120
%Financed	**.161**	**.079**	**.235**	**2.041**	**.048**	**.206**	**.141**
%MinFac	**-.683**	**.336**	**-.202**	**-2.036**	**.048**	**-.219**	**-.140**
%FemFac	.081	.147	.046	.548	.587	-.002	.038
GRE	-.018	.067	-.030	-.277	.783	.298	-.019
#Activities	**2.092**	**.818**	**.266**	**2.558**	**.014**	**.147**	**.176**
1styrsize	-.099	.349	-.047	-.283	.778	.107	-.020
%FemStud	**-.524**	**.159**	**-.311**	**-3.305**	**.002**	**-.599**	**-.228**
TTD	**-8.913**	**2.124**	**-.355**	**-4.197**	**.000**	**-.302**	**-.289**
%MinStud	-.007	.229	-.003	-.029	.977	-.252	-.002
#Faculty	.138	.177	.090	.783	.438	.483	.054
%RA	-15.813	11.702	-.110	-1.351	.184	-.197	-.093
%TA	**-20.551**	**6.543**	**-.281**	**-3.141**	**.003**	**-.413**	**-.217**
Ratio	9.225	5.477	.200	1.684	.100	.321	.116
Orient	-11.228	7.423	-.153	-1.513	.138	.130	-.104
AnREV	-5.400	4.726	-.115	-1.142	.260	.178	-.079

[15] Although the variable Belonging has a negative coefficient, the relationship should be considered positive since the ratings were scaled inversely: (1) Very Satisfied (2) Somewhat Satisfied and (3) Not Satisfied.

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Table 13: Multiple Regression Results for English (*n*=88)

Coefficients							
Model: *English*	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Correlations	
	B	Std. Error	Beta			Zero-order	Part
(Constant)	-46.746	73.531		-.636	.527		
Satisfaction	3.839	16.405	.047	.234	.816	-.116	.022
Belonging	-14.018	17.358	-.161	-.808	.422	-.159	-.077
%wMentor	.294	30.642	.001	.010	.992	.060	.001
%Married	13.438	18.927	.105	.710	.480	-.007	.068
%wKids	4.721	19.078	.037	.247	.805	-.001	.024
%FacGrants	-.308	.284	-.120	-1.086	.282	-.057	-.104
%Financed	.106	.085	.147	1.248	.217	.168	.119
%MinFac	.438	.524	.109	.836	.406	.037	.080
%FemFac	-.457	.264	-.198	-1.730	.088	-.230	-.165
GRE	**.145**	**.065**	**.348**	**2.238**	**.029**	**.036**	**.214**
#Activities	1.783	1.495	.153	1.193	.237	.163	.114
1styrsize	**2.051**	**.487**	**.723**	**4.208**	**.000**	**.286**	**.402**
%FemStud	-.020	.280	-.008	-.071	.944	-.089	-.007
TTD	-2.688	1.760	-.178	-1.527	.131	-.260	-.146
%Minstud	-.248	.386	-.080	-.643	.522	-.022	-.061
#Faculty	**-.723**	**.222**	**-.513**	**-3.262**	**.002**	**.018**	**-.312**
%RA	-19.100	42.840	-.047	-.446	.657	-.009	-.043
%TA	7.186	7.225	.113	.995	.324	.148	.095
Ratio	**31.009**	**13.284**	**.372**	**2.334**	**.023**	**-.015**	**.223**
Orient	.961	10.838	.011	.089	.930	.162	.008
AnREV	-6.306	5.037	-.139	-1.252	.215	.001	-.120

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Table 14: Multiple Regression Results for All Programs (*N*=365)

	Coefficients						
Model: *All Programs*	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Correlations	
	B	Std. Error	Beta			Zero-order	Part
(Constant)	**101.156**	**27.846**		**3.646**	**.000**		
Satisfaction [16]	**-12.473**	**4.975**	**-.157**	**-2.507**	**.013**	**-.242**	**-.112**
Belonging	-4.013	5.792	-.047	-.693	.489	-.133	-.031
%wMentor	-15.958	9.891	-.091	-1.613	.108	-.004	-.072
%Married	.268	6.895	.002	.039	.969	-.067	.002
%wKids	-5.990	8.441	-.044	-.710	.478	-.115	-.032
%FacGrants	**-.109**	**.042**	**-.211**	**-2.598**	**.010**	**-.019**	**-.116**
%Financed	**.191**	**.048**	**.207**	**3.951**	**.000**	**.139**	**.176**
%MinFac	.067	.166	.020	.406	.685	.052	.018
%FemFac	.138	.092	.127	1.494	.136	.079	.067
GRE	-.027	.025	-.094	-1.116	.265	-.019	-.050
#Activities	**1.242**	**.464**	**.132**	**2.675**	**.008**	**.187**	**.119**
1styrsize	**.564**	**.180**	**.255**	**3.130**	**.002**	**.089**	**.140**
%FemStud	.089	.079	.091	1.129	.260	.078	.050
TTD	**-5.836**	**.903**	**-.353**	**-6.465**	**.000**	**-.319**	**-.289**
%MinStud	-.036	.113	-.015	-.317	.751	-.007	-.014
#Faculty	**-.180**	**.073**	**-.184**	**-2.458**	**.014**	**-.027**	**-.110**
%RA	2.343	4.175	.033	.561	.575	.063	.025
%TA	**-12.582**	**3.716**	**-.189**	**-3.386**	**.001**	**-.163**	**-.151**
Ratio	3.643	3.629	.070	1.004	.316	-.031	.045
Orient	5.753	3.297	.085	1.745	.082	.175	.078
AnREV	**-5.671**	**2.365**	**-.117**	**-2.398**	**.017**	**-.021**	**-.107**

[16] Although the variable Satisfaction has a negative coefficient, the relationship should be considered positive since the ratings were scaled inversely: (1) Very Satisfied (2) Somewhat Satisfied and (3) Not Satisfied.

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Table 15: Summary of the Multiple Regression Analysis for Each Field

	Df1 - Effect df	*Df2 - Residual df*	*F*	*Significance (p-value)*	*R^2*	*Adj. R^2*	*Stand. Error Estimate*
Neuroscience	20	37	3.660	.000	66.4%	48.3%	12.1%
Chemical Engineering	20	34	2.472	.010	59.3%	35.3%	11.6%
Physics	20	79	6.360	.000	61.7%	52.0%	9.5%
Economics	21	42	8.014	.000	80.0%	70.0%	9.8%
English	21	66	2.076	.013	39.8%	20.6%	16.4%
All Programs	21	343	7.540	.000	31.6%	27.4%	15.4%

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Table 16: Independent T-test / Chi-Square Results for *Neuroscience*

Significant Factors	***Low Completion Group Means (n=21)***	***High Completion Group Means (n=16)***	***t***	***df***	***Significance (p-value)***	***Cohen's d***[17]
Satisfaction	1.49	1.46[18]	-.584	35	.563	
Belonging	1.42	1.42[19]	.038	35	.970	
%wMentor	93%	93%	.122	35	.903	
%Married	32%	36%	-.944	35	.352	
%wKids	13%	17%	-1.251	35	.219	
%FacGrants	91%	92%	-.068	35	.946	
%Financed	97%	99%	-.888	35	.381	
%MinFac	3.8%	2.0%	1.771	35	.085	
%FemFac	22.5%	27.4%	-1.850	35	.073	
GRE	713	707	.400	35	.692	
#Activities	16.7	16.9	-.377	35	.708	
1st Yr Size	10	9	.916	33	.367	
%FemStud	51.3%	51.7%	-.151	35	.881	
TTD	**6.3 years**	**5.6 years**	**4.2**	**35**	**.000**	**1.42**
%MinStud	10.7%	13.4%	-1.114	35	.273	
#Faculty	54	40	1.510	35	.140	
#Enrolled	57	47	1.194	35	.240	
%RA	29%	28%	.121	35	.905	
%TA	4.9%	.4%	1.960	21	.064	
Ratio	1.01	.89	.900	35	.374	

Significant Factors	**Low Completion Group Percentage**	**High Completion Group Percentage**	***χ^2***	***df***	**Significance (p-value)**	**Cramer's *v***
Orient	90%	100%	1.611	1	.204	
AnRev	95%	94%	.039	1	.843	

[17] Effect Sizes are only shown when $p \leq .05$

[18] The researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher satisfaction ratings.

[19] This researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher sense of belonging ratings.

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Table 17: Independent T-test / Chi-Square Results for *Chemical Engineering*

Significant Factors	***Low Completion Group Means (n=13)***	***High Completion Group Means (n=14)***	***t***	***df***	***Significance (p-value)***	***Cohen's d***[20]
Satisfaction[21]	1.38	1.55	1.865	25	.074	
Belonging[22]	1.55	1.60	.737	25	.468	
%wMentor	77%	82%	-.705	25	.487	
%Married	44%	38%	.736	17	.472	
%wKids	21%	15%	1.238	25	.227	
%FacGrants	90%	85%	1.415	25	.169	
%Financed	97%	94%	.732	25	.471	
%MinFac	4.3%	6.8%	-1.092	25	.285	
%FemFac	9.6%	11.0%	-.504	17	.621	
GRE	761	776	-1.984	25	.058	
#Activities	15.2	16.5	-1.791	25	.085	
1st Yr Size	**9**	**17**	**-2.713**	**19**	**.014**	**-1.03**
%FemStud	31.3%	29.5%	.590	25	.560	
TTD	5.02 years	4.75 years	1.039	25	.309	
%MinStud	11.6%	9.7%	.633	25	.533	
#Faculty	**14**	**22**	**-2.192**	**17**	**.043**	**-.83**
#Enrolled	**42**	**79**	**-2.482**	**16**	**.024**	**-.94**
%RA	43%	54%	-1.046	25	.306	
%TA	15%	12%	.364	25	.719	
Ratio	.38	.32	1.172	25	.252	

Significant Factors	**Low Completion Group Percentage**	**High Completion Group Percentage**	***χ²***	***df***	**Significance (*p*-value)**	**Cramer's *v***
Orient	92%	93%	.003	1	.957	
AnRev	69%	57%	.422	1	.516	

[20] Effect Sizes only shown when p≤.05

[21] The researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher satisfaction ratings.

[22] This researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher sense of belonging ratings.

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Table 18: Independent T-test / Chi-Square Results for *Physics*

Significant Factors	***Low Completion Group Means (n=26)***	***High Completion Group Means (n=23)***	***t***	***df***	***Significance (p-value)***	***Cohen's d***[23]
Satisfaction[24]	1.31	1.37	1.032	47	.307	
Belonging[25]	1.45	1.42	-.663	47	.510	
%wMentor	84%	79%	1.653	47	.105	
%Married	47%	42%	1.201	47	.236	
%wKids	**26%**	**14%**	**2.998**	**47**	**.004**	**.87**
%FacGrants	82%	85%	-.888	41	.380	
%Financed	95%	99%	-1.704	33	.098	
%MinFac	4.5%	2.9%	1.075	47	.288	
%FemFac	10.8%	7.5%	1.082	47	.285	
GRE	**757**	**775**	**-2.085**	**47**	**.043**	**-.60**
#Activities	15.5	16.0	-.763	47	.449	
1st Yr Size	**14**	**19**	**-2.288**	**34**	**.028**	**-.66**
%FemStud	19.4%	20.6%	-.607	47	.547	
TTD	**6.7years**	**5.2 years**	**5.496**	**47**	**.000**	**1.59**
%MinStud	8.8%	5.7%	1.582	47	.120	
#Faculty	**28**	**41**	**-2.366**	**30**	**.025**	**-.69**
#Enrolled	**66**	**99**	**-2.258**	**30**	**.031**	**-.66**
%RA	34%	44%	-1.700	46	.096	
%TA	38%	29%	1.341	46	.186	
Ratio	.46	.46	.207	47	.837	

Significant Factors	**Low Completion Group Percentage**	**High Completion Group Percentage**	***χ^2***	***df***	**Significance (*p*-value)**	**Cramers *v***
Orient	85%	91%	.508	1	.476	
AnRev	85%	96%	1.622	1	.203	

[23] Effect Sizes only shown when p≤.05

[24] This researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher satisfaction ratings.

[25] This researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher sense of belonging ratings.

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Table 19: Independent T-test / Chi-Square Results for *Economics*

Significant Factors	***Low Completion Group Means (n=19)***	***High Completion Group Means (n=18)***	***t***	***df***	***Significance (p-value)***	***Cohen's d***[26]
Satisfaction[27]	**1.18**	**1.44**	**3.341**	**35**	**.002**	**1.09**
Belonging[28]	**1.29**	**1.57**	**2.176**	**26**	**.039**	**.72**
%wMentor	81%	81%	.011	35	.991	
%Married	46%	45%	.260	35	.797	
%wKids	24%	17%	1.605	35	.117	
%FacGrants	**36%**	**49%**	**-2.177**	**35**	**.036**	**-.72**
%Financed	72%	84%	-1.436	35	.160	
%MinFac	7.3%	4.0%	1.808	35	.079	
%FemFac	13.8%	15.4%	-.610	35	.546	
GRE	758	779	-2.009	35	.052	
#Activities	15.7	16.3	-.714	35	.480	
1st Yr Size	15	18	-.997	35	.326	
%FemStud	**43.8%**	**26.9%**	**5.204**	**35**	**.000**	**1.71**
TTD	5.9 years	5.4 years	1.761	24	.091	
%MinStud	**10.6%**	**5.5%**	**2.325**	**35**	**.026**	**.76**
#Faculty	**22**	**36**	**-3.815**	**35**	**.001**	**-1.26**
#Enrolled	67	86	-1.389	30	.175	
%RA	**13%**	**5%**	**2.559**	**25**	**.017**	**.85**
%TA	**47%**	**20%**	**4.160**	**34**	**.000**	**1.36**
Ratio	**.38**	**.70**	**-2.162**	**21**	**.042**	**-.70**

Significant Factors	**Low Completion Group Percentage**	**High Completion Group Percentage**	***χ^2***	***df***	**Significance (*p*-value)**	**Cramer's *v***
Orient	83%	95%	1.247	1	.264	
AnRev	67%	84%	1.546	1	.214	

[26] Effect Sizes only shown when $p \leq .05$

[27] This researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher satisfaction ratings.

[28] This researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher sense of belonging ratings.

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Table 20: Independent T-test / Chi-Square Results for *English*

Significant Factors	***Low Completion Group Means (n=26)***	***High Completion Group Means (n=27)***	***t***	***df***	***Significance (p-value)***	***Cohen's d***[29]
Satisfaction[30]	1.38	1.46	1.362	51	.179	
Belonging[31]	1.21	1.33	1.952	51	.056	
%wMentor	89%	91%	-1.143	40	.260	
%Married	48%	47%	.207	51	.837	
%wKids	27%	26%	.231	51	.818	
%FacGrants	9%	8%	.460	51	.648	
%Financed	78%	86%	-1.080	51	.285	
%MinFac	8.7%	8.7%	-.004	51	.997	
%FemFac	48.0%	44.7%	1.637	51	.108	
GRE	646	651	-.399	45	.692	
#Activities	15.8	16.5	-1.524	51	.134	
1st Yr Size	11	15	-1.893	36	.066	
%FemStud	61.2%	59.8%	.661	51	.511	
TTD	**7.7 years**	**6.7 years**	**2.886**	**51**	**.006**	**.79**
%MinStud	9.6%	9.7%	-.060	51	.952	
#Faculty	36	37	-.267	51	.790	
#Enrolled	75	82	-.650	51	.519	
%RA	2%	1%	.965	51	.339	
%TA	43%	47%	-.509	51	.613	
Ratio	.52	.55	-.523	51	.603	

Significant Factors	**Low Completion Group Percentage**	**High Completion Group Percentage**	***χ²***	***df***	**Significance (*p*-value)**	**Cramers *v***
Orient	89%	100%	3.062	1	.080	
AnRev	78%	81%	.072	1	.788	

[29] Effect Sizes only shown when p≤.05

[30] This researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher satisfaction ratings.

[31] This researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher sense of belonging ratings.

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Table 21: Independent T-test / Chi-Square Results for *All Programs*

Significant Factors	***Low Completion Group Means (n=116)***	***High Completion Group Means (n=102)***	***t***	***df***	***Significance (p-value)***	***Cohen's d***[32]
Satisfaction[33]	**1.34**	**1.46**	**3.793**	**214**	**.000**	**.51**
Belonging[34]	1.39	1.44	1.693	216	.092	
%wMentor	86%	85%	.806	216	.421	
%Married	44%	41%	1.440	216	.151	
%wKids	**22%**	**18%**	**2.023**	**216**	**.04**	**.28**
%FacGrants	60%	60.8%	-.129	216	.898	
%Financed	**87%**	**94%**	**-2.481**	**202**	**.014**	**-.33**
%MinFac	5.0%	5.8%	-1.118	216	.265	
%FemFac	19.8%	22.9%	-1.385	216	.167	
GRE	733	732	.058	199	.954	
#Activities	**15**	**17**	**-3.808**	**187**	**.000**	**1.13**
1st Yr Size	13.5	14.9	-1.275	216	.204	
%FemStud	36.8%	39.8%	-1.239	216	.217	
TTD	**6.4 years**	**5.6 years**	**5.585**	**216**	**.000**	**.76**
%MinStud	9.2%	9.1%	.109	216	.913	
#Faculty	33	31	.665	216	.506	
#Enrolled	68	75	-1.222	205	.223	
%RA	21%	27%	-1.741	183	.083	
%TA	**35%**	**20%**	**4.052**	**216**	**.000**	**.55**
Ratio	.55	.53	.585	216	.559	

Significant Factors	**Low Completion Group Percentage**	**High Completion Group Percentage**	***χ^2***	***df***	**Significance (*p*-value)**	**Cramer's *v***[35]
Orient	**86%**	**98%**	**10.031**	**1**	**.002**	**.215**
AnRev	80%	83%	.362	1	.547	

[32] Effect Sizes only shown when p≤.05
[33] This researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher satisfaction ratings.
[34] This researcher used the formula (3 – the original rating values) in order for the higher means to reflect higher sense of belonging ratings.
[35] Effect Sizes only shown when p≤.05

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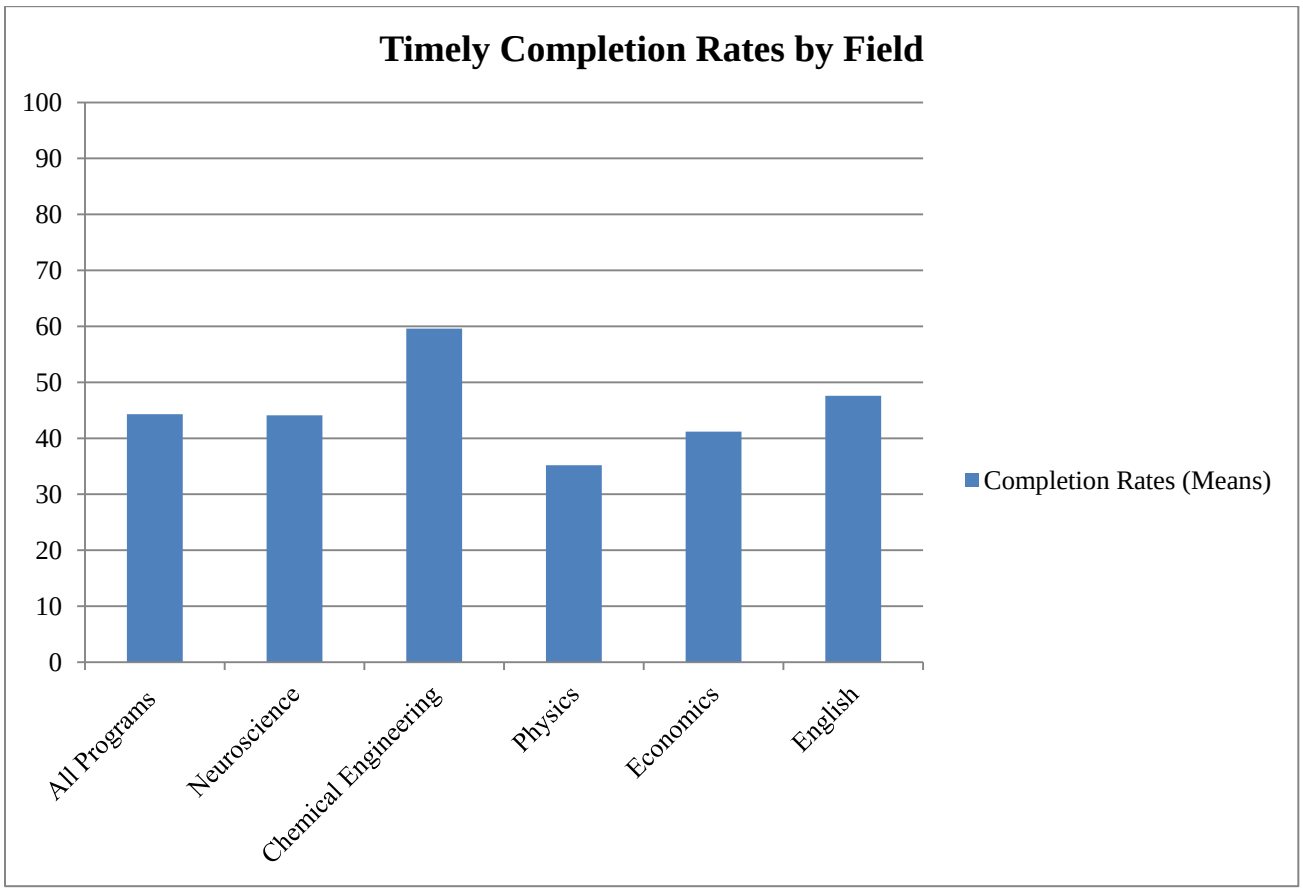

Figure 2: Timely Completion Rates by Field

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CHAPTER FIVE

FINDINGS, IMPLICATIONS AND RECOMMENDATIONS

Introduction

This final chapter provides a summary of the completed study. It reviews the methodology used in conducting the analyses, and presents findings for each research question. Furthermore, conclusions based on the findings of the study – as well as implications of these findings – are discussed. This chapter closes with limitations, recommendations for future research, and concluding remarks.

Summary of the Study

Roughly half of all doctoral students who begin a program do not continue through graduation, and many of them face significant financial losses and emotional burdens as a result. Although this completion rate has stayed fairly constant for the past few decades, it has recently gained attention on a national level. As policy makers begin to consider ways to increase completion rates, it is becoming clear that this burden of responsibility does not fall on a single party – it will require the efforts of everyone involved.

This researcher used data from the National Research Council's *Data-Based Assessment of Research-Doctorate Programs in the United States* to examine the relationships between timely doctoral completion rates and 22 variables, and to compare high and low completion-rate programs in the following five fields: Neuroscience, Chemical Engineering, Physics, Economics and English. In fulfillment of the purposes of this study, the analyses revealed which factors

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were significant predictors of completion rates, and which significant differences exist between low- and high-completing programs. Furthermore, the study showed that up to 80% of the variance in timely completion rates was accounted for by measurable data. Program leaders and other interested parties can use these findings to focus their efforts on factors that are pertinent to completion rates within their fields.

Review of the Methodology

A quantitative correlational design was used to analyze secondary data from the National Research Council's *Assessment of Research Doctorate Programs in the United States*. Multiple regression analyses were conducted to measure the relationship between the predicted timely doctoral completion rates and 22 independent variables, and independent t-tests and chi-squares were used to examine differences between low and high completion-rate programs across the 22 variables.

The sample included over 10,000 students and over 12,000 faculty members from 365 programs in the following five fields: Neuroscience, Chemical Engineering, Physics, Economics and English. Descriptive statistics were reported for all variables in the study, and residual plots were provided in Appendices J through O. Pearson Correlation Coefficients and Variance Inflation Factors were used to assess multicollinearity, and Levene's test was used to assess the equality of variances. Analysis of the data was completed using SPSS software.

Principle Findings

Research Question One

The first research question in this study was:

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What is the relationship between timely doctoral completion rates[36] and the following variables (availability of graduate orientations, number of student support activities, average first year enrollment size, total number of enrolled students, percent of first year students with full financial support, percent of students with teaching assistantships, percent with research assistantships, median time to degree, existence of an annual student review, average GRE score, percent of students that are married, percent of students with dependents, percent of students with mentors, average satisfaction ratings with program, average sense-of-belonging rating, percent of students that are female, percent that are minorities, percent of faculty with grants, percent of faculty that are female, percent that are minorities, total number of faculty, and faculty to student ratio) in the:

a. *Neuroscience* field?
b. *Chemical Engineering* field?
c. *Physics* field?
d. *Economics* field?
e. *English* field?
f. *All Programs* group from these 5 fields combined?

A model summary was produced for each of the five fields to indicate the relationships between timely doctoral completion rates and 22 Program, Student, and Faculty variables. An additional model summary was produced to present the relationship between timely completion rates and the 22 variables for all the programs in the dataset – regardless of field. Standardized

[36] Within 6 years for programs in Neuroscience, Chemical Engineering and Economics, or within 8 years for programs in English.

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beta weights were presented as well to indicate each significant variable's contribution toward predicting timely completion rates in each field.

Question 1a: Programs in *Neuroscience* with a higher percentage of students with full financial support, a shorter time to degree, and a higher percentage of female faculty members were associated with higher completion rates, after controlling for the other variables. See Table 22, p. 104, for a concise summary of the three significant variables from the multiple regression analysis. According to the standardized beta weights provided in the table, Time to Degree and Full Financial Support had the strongest relationships with timely completion rates in *Neuroscience*.

Question 1b: In *Chemical Engineering*, programs with a higher percentage of minority faculty, a higher number of activities, and a larger 1st year size were associated with higher completion rates, after controlling for the other variables. There were no significant negative relationships in this model. See Table 23, p. 104, for a summary of all the significant variables from the multiple regression analysis in *Chemical Engineering*. In this field, 1st year size had the strongest relationship with timely completion rates, as indicated by the standardized beta weights.

Question 1c: Programs in *Physics* with higher quantitative GRE scores were associated with higher completion rates, after controlling for the other variables. Programs with a higher percentage of female faculty and a longer average time to degree, on the other hand, were associated with lower average completion rates. Time to Degree had a substantially stronger relationship with completion rates than the other variables in this field. See Table 24, p. 105, for a summary of the three significant variables from the multiple regression analysis in *Physics*.

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Question 1d: In *Economics,* programs that had a higher percentage of students with full financial support, a higher number of activities, and a higher average student sense-of-belonging rating were associated with higher completion rates, after controlling for the other variables in the model. On the other hand, programs with higher percentages of minority faculty, female students, and teaching assistants were associated with lower average completion rates. Longer median time to degree was negatively related to completion rates as well. The *Economics* field had eight significant variables, and percentage of students with mentors and Time to Degree had the strongest relationship with completion rates in this field. See Table 25, p. 105, for a summary of all the significant variables from the multiple regression analysis in *Economics*.

Question 1e: After controlling for the other variables, programs in *English* with higher GRE scores, larger 1st year sizes, and higher faculty to student ratios were associated with higher completion rates. Programs in this field with a higher number of faculty, on the other hand, were associated with lower average completion rates. 1st year size had the strongest relationship with completion rates in English, followed by number of faculty. Table 26, p. 106, presents a summary of all the significant variables from the multiple regression analysis in *English*.

Question 1f: When looking at all the programs in the study, those with a higher number of activities, a higher percentage of students with full financial support, a larger 1st year size, and a higher average student satisfaction rating were associated with higher completion rates, after controlling for the other variables in the model. On the opposite end, programs with a longer average time to degree, a higher percentage of faculty with grants, and a higher percentage of teaching assistants were associated with lower average completion rates. According to the standardized beta weights, Time to Degree and 1st year size had the strongest relationships with

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completion rates in the *All Programs* group. See Table 27, p. 106, for a summary of all the significant variables from the *All Programs* regression analysis.

Research Question Two

The second research question in the study was:

When comparing doctoral programs with high completion rates and those with low completion rates[37], which variables show statistically significant differences in the:

a. *Neuroscience* field?

b. *Chemical Engineering* field?

c. *Physics* field?

d. *Economics* field?

e. *English* field?

f. *All Programs* group from these 5 fields combined?

In *Neuroscience* and *English*, programs with high completion rates on average had a statistically significant shorter time to degree than programs with low completion rates. *Chemical Engineering* programs with high completion rates had significantly larger 1st year sizes, more faculty members, and more students. High completion-rate programs in *Physics* had a significantly lower percentage of students with children, a higher average GRE score, a larger 1st year size, a shorter average time to degree, more faculty members, and more enrolled students than *Physics* programs with low completion rates. Finally, programs with high completion rates in *Economics* had significantly higher student satisfaction ratings, higher student sense-of-belonging ratings, a higher percentage of faculty with grants, lower percentages of female and

[37] Exact cut-offs for high- and low-completion groups in each field are presented in Table 6 (Chapter 4).

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minority students, more faculty members, lower percentages of teaching and research assistants, and a higher faculty to student ratio.

When comparing all the programs in the dataset, high-completing programs on average had higher satisfaction ratings, a lower percentage of students with children, a higher percentage of students with full financial support, a higher number of support activities, shorter times to degree, a lower percentage of teaching assistants, and a higher percentage of programs that offered Orientations than low-completing programs. Table 28 (p. 107) provides a summary of variables with significant differences by field and indicates whether the High Completion group means were higher or lower than the Low-Completion group means.

Conclusions

All of the regression models in the study were significant below the $p \leq .05$ level so an important primary conclusion is that future researchers should continue to use objective data for building predictive equations of completion rates. Secondly, all of the fields, with the exception of English, had overlapping significant variables between those that contributed significantly to predicting completion and those that were significantly different between low and high completing groups (see Figures 3 – 8, pp. 108-110). Specifically, shorter time to degree was significant in both analyses for *Neuroscience* and *Physics*; 1st year size was significant for both analyses in *Chemical Engineering*; Percentage of female students, percentage of teaching assistants, and sense of belonging rating were significant in both analyses for *Economics*; and lastly, the *All Programs* group showed significance in both the multiple regression and independent t-test analyses for number of activities, percentage of students with full financial support, median time to degree, and overall satisfaction ratings. Additional conclusions from each analysis are presented independently below.

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Multiple Regression Conclusions

For this study, the regression analysis used the 22 independent variables from each program to create the formula that would best predict those programs' completion rates. Multiple regression analysis also provides a R^2 value which shows how well the resulting regression line matches the original data points. Although the R^2 value revealed that only 30% to 40% of the variance in completion rates was explained by the variables in the *English* and *All Programs* models, the same set of variables explained 60%-80% of the variance for the other four fields. In other words, completion rates were predicted accurately for 60%-80% of the programs in the data set within those four fields. The adjusted R^2 values (which are less biased and more probable for new samples) ranged between 50% and 70% for three fields. Thus, the use of this particular set of variables is extremely useful for predicting timely completion rates in Neuroscience, Physics and Economics.

In four of the six groups (*Neuroscience, Physics, Economics, and All Programs)*, shorter time to degree was significantly related to have higher completion rates. Previous studies also noted that programs with higher completion rates tend to have relatively short times to degree (Tuckman, 1991; Bowen & Rudenstine, 1992; Nerad & Cerny, 1993) however this study went a step further in finding that median Time to Degree had significant value in predicting timely completion rates. A higher number of student-support activities, a larger percentage of students with full financial support, and a larger 1st year size also contributed to higher predicted completion rates in three groups each. Pinkston (1987), King and Cheraptor (1996), and Barker et al. (1997) similarly found that institutions with support programs were associated with higher retention rates than institutions without those programs. The positive relationship between Full Financial Support and completion rate was also corroborated by previous findings (Ehrenberg

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and Mavros, 1995, Ferrer de Valero, 2001). Regarding size of program, Bowen and Rudenstine's (1992) study indicated that smaller programs were significantly related to higher completion rates. This study's finding, on the other hand, was consistent with the Council of Graduate School's analysis of baseline program data where *larger* programs (defined by cohort size) were more likely to have higher completion rates (2007).

In two out of the six groups, the following variables had significant relationships with completion rates: Percentage of teaching assistants, student ratings of satisfaction, student sense of belonging ratings, and GRE scores. Girves and Wemmerus (1988) observed that students who were employed as either teaching or research assistants were more likely to become involved in their programs and to earn doctorates, while Ehrenberg and Mavros (1995) found that students with teaching assistantships had lower completion rates than those with fellowships or research assistantships. This study had similar findings to the latter study as higher completion rates were associated with lower percentages of students with teaching assistantships. One possible explanation is that students who are spending time preparing for their teaching load find it more difficult to complete their own coursework and/or dissertation.

Student ratings of satisfaction and sense of belonging had negative relationships with average completion rates in *Economics* and *All Programs,* which should actually be interpreted as *positive* relationships since the lower the score for these two variables, the higher the ratings (1=Very Satisfied, 2=Somewhat Satisfied, 3=Not Satisfied). This finding is also similar to results from past studies where student's detachment or isolation from a program was related to dropping out (Cooke et al., 1995; Bowen & Rudenstine, 1992, Nerad & Cerny, 1993). Past studies disagree on the relationship between GRE scores and completion; in this study, higher GRE scores were significantly related with higher completion rates in *Physics* and *English.*

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In terms of faculty diversity, two groups (*Neuroscience* and *Chemical Engineering*) had positive relationships between female / minority faculty and timely completion rates while two groups (*Physics* and *Economics*) had negative relationships between female students or female/minority faculty and average completion rates. In *Neuroscience,* where programs with a higher percentage of female faculty were associated higher completion rates, half of the student population was female. In *Physics*, on the other hand, where the percentage of female faculty was negatively related to completion rates, only 19% of the student population was female. Thus, it is possible that the percentages of female or minority students in each field have a bearing on the relationships between faculty diversity and completion rates, however additional research is needed in this area to corroborate this finding.

Finally, the following variables made significant contributions in one program each: faculty to student ratio was positively related to completion rates in *English*, while lower percentages of faculty with grants and lower percentages of students with mentors were associated with higher completion rates in *All Programs* and *Economics*, respectively. Milem et al. (2000) found that there has been an increase in time spent on research and teaching activities in recent years with a resulting decrease in time spent on advising/counseling. Future research could determine if the negative relationship between percentage of faculty with grants and timely completion rates might be related to this decrease in time spent on advising / counseling. Regarding mentorship, previous studies generally note a positive relationship between completion and the "right" mentor. This study, however, found no significant relationships between mentoring and completion in any of the groups except for *Economics* – where the relationship was negative. This unexpected finding is further discussed in the *Implications* section.

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Independent T-test and Chi-Square Conclusions

This study also compared the means of each independent variable between low and high-completing programs in each of the five fields and in the *All Programs* group. Apart from Time to Degree and program size variables (1st year size, number of faculty, and number of enrolled students), the five fields did not share any other significant differences between High and Low Completion groups. In other words, each field was unique in the set of significant differences that existed between the two groups. Since it is possible that programs within each field are run in a similar fashion, the findings from the *All Programs* analysis revealed additional differences between programs, regardless of field.

Time to Degree was significantly shorter for the High-Completion group in *Neuroscience, Physics, English,* and *All Programs*, and the number of faculty was significantly higher in three of the groups. As previously noted, other studies have found that higher completion rates are associated with shorter times to degrees, and that larger programs are related to higher completion rates. Student satisfaction ratings, 1st year size, and number of enrolled students were all significantly higher for High-Completers in two groups each, while the percentage of students with dependents was significantly lower for High-Completers in two groups. Regarding the finding related to dependents, it seems that the additional responsibility of caring and providing for children makes it more difficult to complete the degree. Cohen (2011) and Lee (2006) similarly found that students pursuing a Ph.D. often found it difficult to balance their studies, work and care of their families.

Implications for Program Administrators and Students

According to the NSF Doctorate Record File, the 2006 NRC study accounted for approximately 90% of all the doctorates awarded in 2005-2006 within the represented fields.

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This study then included approximately 60% of the programs from the NRC study within the five fields. Thus, the results from this study are reasonably generalizable to programs in Neuroscience, Chemical Engineering, Physics, Economics, and English. As there are different implications for program administrators and students in each field, this section is organized accordingly.

Neuroscience

Implications for Program Administrators in Neuroscience

According to the findings in this study, *Neuroscience* programs that offer a higher percentage of female faculty and more financial support were associated with higher completion rates, after controlling for the other variables. The average percentage of female faculty in *Neuroscience* is 24%, whereas the average female student population is 51%. More research is needed in this area to determine if the higher completion rates in this field are related to the higher probability of female students working with female mentors. In terms of financial support, financial burdens are a commonly cited barrier to completion in doctoral programs (Jones, 1987; Leadabrand, 1985; Ferrer de Valero, 2001) so it naturally follows that full financial support would be a tremendous help toward completion. Thus, program administrators in the Neuroscience field should hire additional female faculty if possible and provide additional financial support. Based on both the regression analysis and the t-test, *Neuroscience* programs should also encourage students to finish their requirements as quickly as possible since higher completion rates are associated with a shorter time to degree.

Implications for Students in Neuroscience

Specifically for students in Neuroscience, programs that have a higher percentage of students with dependents were associated with lower graduation rates. That does not necessarily

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mean that students who have children should not pursue a doctoral degree in Neuroscience, however it does suggest that they should ask themselves if family or financial support is in place for childcare. And if not, perhaps they should seek out a program that offers childcare assistance as one of their support activities.

Other factors that are positively related to completion in Neuroscience include a higher percentage of female faculty and full financial support. If a student is seeking a female mentor within the doctoral program, that student should consider that program's percentage of female faculty – as well as the ratio of female faculty to students – to determine if attaining a female mentor is a realistic possibility. The second variable, full financial support, measured the percentage of first year students who received full financial support from the program. This variable did not include financial support from a job or from family, nor did it consider how long the support was provided (for one year, three years, or through completion). Thus, based on the definition of this variable, students in the Neuroscience field should seek out programs that offer fellowships, assistantships, and/or internships to a high percentage of entering students. The only significant difference from the t-test comparisons between high and low completing programs in Neuroscience was Time to Degree. Thus, students in this field should also try to complete in as short a time as possible.

Chemical Engineering

Implications for Program Administrators in Chemical Engineering

According to the significant t-test differences in Chemical Engineering, programs with high completion rates had larger first year sizes, more faculty members and more students than the low completion group. Interestingly, all three of the findings in this field relate to program

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size. Previous findings disagree on this issue. Some studies revealed that students in smaller entering classes had more individualized attention and better chances of completing through graduation. This study, however, found that in general, larger programs have a significantly higher graduation rate than smaller programs.

According to the regression analysis, programs in this field with more support activities and more minority faculty are associated with higher completion rates. Thus, it seems that Chemical Engineering programs that can offer additional support activities and hire additional minority faculty should do so, especially since there is such a high percentage of international students in the Engineering fields. Writing support, in particular, has been found to be most helpful to international students in the STEM fields.

Implications for Students in Chemical Engineering

After controlling for other variables, programs in Chemical Engineering that have more students, more faculty members, and a larger entering class size are associated with higher completion rates. Thus, students in this field should probably seek out larger programs. The percentage of minority faculty and the number of support activities were also positively related to completion rates – which could be linked to the high proportion of international students in this field. Fortunately, many programs now offer writing assistance, research assistance, and/or language tutoring so international Chemical Engineering students in particular should take full advantage of a program's academic support activities. They might also benefit from seeking out programs with a higher number of international faculty who may better understand issues related to speaking English as a second language.

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Physics

Implications for Program Administrators in Physics

In Physics, the only variable that had a significant positive relationship with timely completion rates was GRE scores. Although past studies have reported inconsistent findings on this test measure, only one field in the entire study showed a negative (non-significant) relationship. Furthermore, GRE scores had a *significantly* positive relationship with completion rates in *Physics* and *English*. Since most programs already have selection criteria in place regarding GRE scores, these differences were significant even within the restricted set of scores. In *Physics* specifically, it seems that higher quantitative scores on the GRE test are indicative of higher completion rates.

The independent t-tests in *Physics* showed several significant differences. Larger size (as measured by 1st year size, number of faculty, and number of enrolled students) was again shown to be a significant difference between higher and lower completing programs. In addition, programs with high completion rates had significantly shorter times to degree and a significantly lower percentage of students with dependents. For program administrators in this field, it would be beneficial to create plans for shortening time to degree, and to let entering students with children know about childcare support at the university if it is available. If childcare support is not available, perhaps *Physics* administrators could take steps toward making it available. They might also consider placing a higher importance on quantitative GRE scores during the selection process, try to enroll more students and hire additional faculty if possible.

Implications for Students in Physics

Time to Degree is negatively related to completion in Physics, so Physics students should attend full time and try not to stop/restart the program. In other words, they should

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attempt to complete the degree in as short a time as possible. Secondly, Physics students ought to consider if having a female mentor is important to them. If so, they should consider the female faculty to student ratio, and seek a female mentor outside the program if one is not available within the department.

Since higher GRE quantitative scores are positively related to completion of a Physics doctoral degree, students interested in this degree could train specifically in the areas that are tested in the quantitative section of the GRE test to improve those skills prior to beginning a Physics program. Lastly, high completing programs were generally larger so students in this field should seek out programs that have many students, many faculty members, and a large entering class size.

Economics

Implications for Program Administrators in Economics

The summary model for this field had a R^2 value of 80%, indicating that 80% of the variance in the timely completion rates of the *Economics* programs in this dataset was explained by the 22 variables used in this study. As such, these findings were the most interesting to the researcher. From the regression analysis, more financial support, higher sense of belonging ratings, and a higher number of support activities had significant positive relationships with completion rates. The benefits of additional financial support and greater number of student activities have already been discussed with respect to the other disciplines. The sense of belonging rating, on the other hand, was not a significant finding for any other field but Economics. One possibility is that networking is extremely important to fields in business. *Economics* programs with students that feel more 'plugged-in' were associated with higher completion rates, after controlling for the other variables. The independent t-test similarly

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showed significant differences between the high and low completion groups in the Belonging and Satisfaction variables. In addition, two other variables that were significantly different between the two groups – number of faculty members and faculty to student ratio – provide greater opportunities for closer interpersonal relationships. So, programs in *Economics* that are looking for possible ways to raise their graduation rates should encourage closer relationships between students and faculty, and possibly host additional functions that encourage interaction.

The significant factors that had a negative relationship with completion rates in *Economics* were time to degree, percentage of minority and female students, percentage of students with teaching assistantships, and percentage of students with mentors. Shorter time to degree was related to higher completion rates, which was not surprising, however the remaining negatively related variables were unexpected by the researcher. The researcher would like to point out again that business fields in general promote a lot of networking and it is possible that a 'boys club' mentality permeates in the *Economics* field. Does the negative relationship between completion and student diversity indicate that programs should enroll fewer female and/or fewer minority students? No, however it does suggest that additional research should look into the reasons behind this finding – especially since the independent T-test also showed that the percentage of female and minority students were significantly lower for the higher completion group. Program administrators in *Economics* might consider exploring what types of additional support can be offered for female and minority students in this field.

The independent t-test in this field revealed that the percentages of teaching assistants and research assistants were both significantly lower for programs with higher completion rates. Regarding teaching assistantships, this finding is consistent with Ehrenberg and Mavros' (1995) findings. Students who spend a lot of time preparing for their teaching responsibilities may not

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have enough time or energy to complete their own coursework and/or dissertation. Thus, *Economics* administrators may consider offering workshops or advising sessions to help prepare assistants for the balancing act between teaching or research and completing degree requirements.

Lastly, the most unexpected finding from the study was the negative relationship between completion rates and the percentage of students with mentors in the field of *Economics*. Since this variable was defined as the percentage of students with mentors inside *or* outside the program, one possible explanation is that Economics students may be seeking out connections related to work, and then choosing to further their career rather than finish their degree. Those mentors may be guiding students on how to succeed financially versus how to complete research. Thus, program administrators who are seeking to increase completion rates could encourage faculty and other mentors within the field to guide students specifically toward completion.

Implications for Students in Economics

For Economics students who intend to persist through completion, they should try to seek out a mentor inside the program – specifically someone who can encourage them to complete the requirements through graduation. Regarding the negative relationship between time to degree and completion rates, once again shorter is better. Satisfaction with the program and Sense of Belonging, on the other hand, were positively related to completion rates so potential students should speak to students enrolled in the program and ask: Are they satisfied with the overall quality of the program? Do they feel like a sense of connectedness and belonging to the program? Is there a sense of camaraderie or a sense of competition among students? Next, if at all possible, students should seek out fellowships rather than teaching or research assistantships as assistants are less likely to finish. If that is not possible, students need to be aware that they

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may be distracted by the assistantship requirements, and create a plan to balance their studies with that work load.

Faculty to student ratio, percentage of students with full financial support and number of activities were also positively related to completion in Economics. Thus, Economics students should consider faculty to student ratio when applying to programs, especially if more individualized attention is important to them. They should also seek out fellowships and grants, and discuss financial obligations with their family prior to beginning a program. Lastly, they should take full advantage of all the support activities available at their institution, and seek out programs that offer more activities rather than less.

English

Implications for Program Administrators in English

The model for *English* programs in the dataset explained 40% of the variance, whereas the other fields had a 60-80% R^2 value. Thus, the researcher would first like to point out that compared to the other fields this model of 22 variables – although significant – did not predict completion rates as strongly in *English.* After controlling for the other variables, programs with a larger 1st year size, higher GRE scores, and a higher faculty to student ratio in *English* were associated with higher completion rates. The actual number of faculty, on the other hand, had a negative relationship with completion rates which might be related to the interdisciplinary nature of the English field. For example, out of all five fields, English is the only one with a foreign language requirement. So although it appears that a higher faculty to student ratio is positively related to completion rates, a higher number of faculty alone is not enough.

The only significant t-test finding was Time to Degree; high completing programs had significantly shorter times to degree than low completing programs. Thus, program

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administrators in this field should seek out ways to shorten times to degree, have larger 1st year sizes, and a higher faculty to student ratio.

Implications for Students in English

The only significant difference from the t-test was Time to Degree so it would be ideal for students in English to have a time table in place when they begin a program, and finish as quickly as possible. Qualitative GRE scores, on the other hand, were positively related to completion so students applying to English programs should sharpen verbal skills that are tested on the GRE, or consider alternate fields if they struggle with many areas on the qualitative section. They should also look for programs that have a higher faculty to student ratio and a larger 1st year size. The standardized beta weights showed that a 1-standard deviation change in 1st year size would produce a .723 increase in a program's timely completion rate. Thus, students in English should pay special attention to the entering class size.

All Programs

Implications for Program Administrators in General

Program administrators and leaders in each field can evaluate where their programs are situated on the continuum of each variable. Then, they can consider if there is room for possible improvement. Is there room to grow into a larger program as bigger programs tend to have higher completion rates? Are there ways to encourage shorter times to degree? Program administrators can also determine if their programs share characteristics with either the high or low completion rate group for significant variables, and then make changes where possible. Should they offer additional support activities? Are they assisting enough students financially? As program administrators, they will obviously need to balance multiple issues related to this

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task, yet the data in this study provides a starting point for selecting which factors to focus on first.

Although each field had varying completion rates, this researcher combined all the programs and ran the analyses on the entire set to discover differences across the board. The primary reason for comparing programs across the fields was to tease out differences that might exist between low and high completing groups, although those differences may not exist within a specific field. For example, the availability of a graduate orientation was not a significant difference within any field, but when comparing low and high completing groups across all fields, it became a significant difference. Thus, these findings would be most pertinent for programs that are open to learning from any field and are seeking to be above the national average as they provide a way to acknowledge differences between programs regardless of field.

In general, the regression analysis for the *All Programs* group was consistent with the analyses of the fields individually. For example, higher satisfaction ratings had a significant positive relationship with completion rates, as did more student support activities, larger first year size, and higher percentage of students with full financial backing. It seems, even on a broad scale, larger is better. Programs that can offer additional academic support should do so, and programs that can enroll larger classes should do that as larger entering classes are also associated with higher completion rates. Financial support was once again found to have a strong positive relationship with completion, as previous findings suggest (Jones, 1987; Leadabrand, 1985, Mavros, 1995; Ferrer de Valero (2001). The variables that had an inverse relationship with completion were: Percent of faculty with grants, time to degree, number of faculty, percent of teaching assistants, and existence of an annual review. A higher percentage of faculty with grants was negatively related to completion rates, which corroborates the theory that faculty who are

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heavily engaged in research may not have the time or energy to devote to mentoring or advising their doctoral students toward completion. A higher percentage of Teaching Assistantships also had a negative relationship with timely completion rates. Similar to faculty on grants, students whose interests are divided between teaching and studying may have a harder time focusing on their own coursework and dissertation and hence not completing. A longer time to degree was also negatively related to completion rates, as were number of faculty and existence of an Annual Review. The relationship between time to degree and completion rate has previously been discussed. Regarding the number of faculty in *All Programs*, programs with fewer core faculty members were associated with higher completion rates. One possible explanation is that forming a dissertation committee requires relationships with outside professors. It is possible that the more interdisciplinary a program is, the more likely those relationships can be formed. Finally, annual review was a categorical variable (1=Yes, 0=No). This factor did not have significance in any of the five fields, however when all the programs were analyzed together, there was a negative relationship between completion and reviewing students annually.

Implications for Students in General

Students who are considering the pursuit of doctoral education can use this data to consider the possible challenges of completing a doctoral degree, and to better prepare themselves for potential obstacles. Although these implications would only apply to students whose goals include completion, students in general probably do not want to waste their time or money. The findings in this study provide suggestions on how to avoid financial (and emotional) burdens from not completing the degree in five fields. The study also revealed that although "life" can get in the way, for the majority of these fields it contributed less than 20-40% of the variance in completion rates.

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According to the findings in the All Programs group, programs with a higher percentage of students who are satisfied with the overall quality of a program are associated with higher completion rates, so students in general should not settle for a program that they consider subpar. Next, the percentage of students that have dependents was negatively related to completion rates, thus students who have children should consider if there is financial and/or family support in place for childacre. If not, perhaps they should seek out programs that provide childcare services. Full financial support is also necessary; the costs of tuition and supplies can become daunting and the burdens of working full time while trying to finish a degree can create an overwhelming amount of stress. Students should seek to have the funding in place, or pursue fellowships and assistantships at the start of a program. Students should also try to get financial assistance outside of a teaching assistantship or create a game plan to ensure that they can balance both the workload of the assistantship and the degree requirements. Programs that offer more student support activities are associated with higher completion rates as well so students in general should look for the support activities that matter to them on a personal level (like research services, editing services, childcare, or ESOL services), and pursue programs that offer those activities. Lastly, this model summary suggests that students should graduate as quickly as possible. In other words, they should try to attend full time and not take semesters off because the likelihood of them completing diminishes greatly.

Implications for Policy Analysts

Although this study was developed with the intent of having program administrators and students as the primary audience, the findings in this study can also assist policy analysts as they lead the public discussion on issues surrounding Ph.D. completion. Of primary importance to policy analysts, this study revealed that variables based on objective data can explain a high

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proportion of the variance in program completion rates. In the past, there has been a definite pull against studies that can induce "finger-pointing," and many educators have cautioned against using objective data in completion studies since it seemed the reasons for completion cannot truly be objective. For four of the five programs in this study however, a rather high proportion of the variance in completion rates *could* be explained through measurable data. Thus, policy analysts should promote the measurement of these variables (and others) for the goals of achieving higher national completion rates.

According to Wendler, et. al (2010), America's future hinges on her capacity to produce advanced degree holders. However, too few students in the U.S. think that a graduate education matters, and other countries have begun to compete for the pool of talented students who do want to pursue a graduate degree (Wendler et. al, 2010). Countries like Australia and New Zealand, for example, are now offering competitive packages to graduate students and are drawing from the U.S.'s talent base. Furthermore, China has begun to produce more PhDs in engineering, math, and science than the U.S., and Europe has similarly begun to produce an increasing number of doctoral graduates (Wendler, et. al, 2010).

As policy analysts continue to uncover these issues that are facing doctoral education, the U.S. needs to remain globally competitive. As mentioned previously, this study revealed that a high percentage of the variability in degree completion can be explained by measurable factors. Further studies on these factors are needed to assist the U.S. in increasing doctoral completion rates and retaining as many graduate students as possible. In addition, studies on international program requirements and completion figures are also necessary for the U.S. to have a baseline of comparison.

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Full financial support was also related to higher graduation rates so analysts should continue to encourage governmental support for the advancement of graduate students. They could promote national initiatives for increasing completion rates and encourage tax policy reviews and amendments for fellowships and scholarships. Lastly, many diversity issues were uncovered in this study. It seems that some fields tend to produce more PhD's when there is a higher percentage of minority or female faculty, while other fields tend to produce less. Additional research is needed specifically in this area, especially as the demographics of the U.S. population continue to shift.

Limitations of the Study

As mentioned in Chapter Three, the primary limitation of this study is that secondary data was used. Thus, this researcher did not have control over the collection of the data, the set parameters of "timely completion", or the exclusion of certain variables or fields. For example, goal orientation, motivational measures, and more intrinsic qualities of the student were not included. Still this researcher believes that the NRC provided an excellent opportunity for analysis by gathering such an enormous amount of objective data.

Secondly, this researcher chose to include data from the Student Questionnaires, which limited the sample size from 4,839 programs to 365 programs. Thus, the *All Programs* group is not truly representative of all U.S. doctoral programs since it was limited to programs in five fields. In other words, although the results from this study are reasonably generalizable to the programs in the five fields, they are not generalizable to all U.S. doctoral programs.

Finally, this study was a completion study – and not an attrition study. Although the two terms are closely related, personal explanations for leaving a program vary tremendously and are not included in this study. It is also possible for a student to begin a program without the intent to

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graduate, or for a program's culture to be such that not all students are expected to graduate – and those mindsets are not accounted for in this study.

Recommendations for Future Research

Only recently have programs begun to collect this type and amount of data on doctoral students, so these findings are just the beginning. The 212 institutions from the NRC study now have electronic databases in place to provide updated information. If institutions in general made those databases available, similar studies to this one could be conducted in every field. Additional future studies could include:

1. Analyses on the completion rates of excluded fields – such as Education or Business.
2. Multiple regression analyses that include additional data on more intrinsic student variables, such as measured motivation or determination.
3. A study that compares degree requirements and completion rates between international and US programs.
4. Studies that examine the causal relationship between Time to Degree and completion rates without the set parameters of 'timely' completion.
5. Studies that examine the differing relationships between diversity and completion rates in multiple fields.
6. Qualitative studies that reveal which variables might contribute to the remaining variance in completion rates.
7. Studies that consider personal motives for non-completion based on exit surveys.
8. Pre- and Post-test studies in programs that implement suggested strategies for increasing completion rates to measure level of impact.

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Concluding Remarks

As a doctoral student doing a study on doctoral completion, I gained a new admiration for the students before me who have persisted to graduation. I also gained a new sympathy and understanding for students who did not finish. Life does not stop for the Ph.D. People still work, they have children, or they may lose a loved one or have to deal with an illness. Yet, it is costly for students, institutions, and society when students do not finish so programs should aim for 100% completion rates. The preconceived notion that it is solely the student's responsibility to finish should no longer be the reigning mentality. Completion should be a team effort – for students, faculty, and program administrators. The pursuit of doctoral education in the United States has long been equated with the pursuit of excellence. As educational opportunities continue to become more global, doctoral programs in the U.S. need to stay competitive by maintaining their level of excellence while graduating more students.

I was expecting there to be countless pieces to the puzzle for predicting completion rates and was surprised to find such high adjusted R^2 values from this model in 3 out of 5 fields. The findings from the Economics field, in particular, suggest that the continuation of analyzing objective data could be the key to elevating completion rates. Students who want to understand the requirements and challenges of doctoral education can look at this data to better equip themselves for the challenges that lie ahead. Department and program leaders can examine differences between high and low completion rates for all programs, and emulate those from the high completion group. For years, it seemed that a "solution" to low completion rates was impossible because it was only based on theories and the blame-game. However, with statistics and objective data, solutions become much more possible.

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On a more personal note, after I began the pursuit of my doctoral degree, I got married, gave birth to two sweet children, buried my father, and moved – twice. As I reviewed the variables in my study, I was flooded with thoughts about what helped me stay on my journey even as "life" continued. First of all, I realize that the relationships I made along the way helped me tremendously: the interim dean of my department told me about numerous fellowships and encouraged me to interview for my first position in the Student Services building; I had an amazing group of peers that I studied with regularly prior to taking my qualifying exam; my major advisor provided timely and helpful feedback on my dissertation throughout the whole writing process, and my committee members graciously met with me multiple times for comments and statistical guidance. I also took advantage of the research support program (CORE) that was available at my institution. I had full financial support throughout my studies, and I also had emotional support and encouragement from my family. Looking back, I can see how all of these factors contributed to my personal success, and I am so thankful that I had so much help along the way. I understand that there could always be another variable that has some impact on the completion of a specific student in a specific program. However, for the variables that we as educators can affect, let's affect them. Ideally, programs in general will consider undertaking comparisons within their fields to determine what they are doing well and what could be improved for the sake of avoiding financial and emotional burdens on students, universities, and society as a whole.

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Tables and Figures

Table 22: Significant Variables and Standardized Beta Weights from the Regression Analysis in Neuroscience

Model Summary	*Positive/Negative Regression Weights*	*Significant Variables*	*Standardized Beta Weights*
Neuroscience	POSITIVE	• % Female Faculty	.296
		• Full Financial Support	.410
	NEGATIVE	• TTD	-.551

Table 23: Significant Variables and Standardized Beta Weights from the Regression Analysis in Chemical Engineering

Model Summary	*Positive/Negative Regression Weights*	*Significant Variables*	*Standardized Beta Weights*
Chemical Engineering	POSITIVE	• The number of activities	.294
		• The percentage of minority faculty	.300
		• 1st year size	.468
	NEGATIVE	[none]	

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Table 24: Significant Variables and Standardized Beta Weights from the Regression Analysis in Physics

Model Summary	*Positive/Negative Regression Weights*	*Significant Variables*	*Standardized Beta Weights*
Physics	POSITIVE	• GRE scores	.236
	NEGATIVE	• The percentage of Female Faculty	-.243
		• Time to Degree	-.661

Table 25: *Significant Variables and Standardized Beta Weights from the Regression Analysis in Economics*

Model Summary	*Positive/Negative Regression Weights*	*Significant Variables*	*Standardized Beta Weights*
Economics	POSITIVE	• Finance	.235
		• Number of Activities	.266
	NEGATIVE	• Percentage of minority faculty	-.202
		• Percentage of students with teaching assistantships	-.281
		• Percentage of female students	-.311
		• Sense of Belonging[38]	-.330
		• Time to degree	-.355
		• Percentage of students with mentors	-.370

[38] Although this variable has a negative value, the relationship between Sense of Belonging and completion rate should be interpreted as positive since lower Sense of Belonging scores indicate higher ratings (1=A lot, 2=Some, 3=Not At All).

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Table 26: *Significant Variables and Standardized Beta Weights from the Regression Analysis in English*

Model Summary	*Positive/Negative Regression Weights*	*Significant Variables*	*Standardized Beta Weights*
English	POSITIVE	• GRE scores	.348
		• Ratio of faculty to students	.372
		• 1st year size	.723
	NEGATIVE	• Number of Faculty	-.513

Table 27: Significant Variables and Standardized Beta Weights from the All Programs Regression Analysis

Model Summary	*Positive/Negative Regression Weights*	*Significant Variables*	*Standardized Beta Weights*
All Programs	POSITIVE	• Number of Activities	.132
		• Full Financial Support	.207
		• 1st Year Size	.255
	NEGATIVE	• AnReview	-.117
		• Satisfaction[39]	-.157
		• # Faculty	-.184
		• TA	-.189
		• Grants	-.211
		• TTD	-.353

[39] Although this variable has a negative value, the relationship between Satisfaction and completion rate should be interpreted as positive since lower Satisfaction scores indicate higher ratings (1=Very Satisfied, 2=Somewhat Satisfied, 3=Not Satisfied).

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Table 28: Variables with significant differences by field plus indications of whether the High Completion group means were higher or lower than the Low-Completion group means.

	Neuroscience	Chemical Engineering	Physics	Economics	English	All Programs
Satisfaction				↑		↑
%wKids			↓			↓
%Financed						↑
#Activities						↑
TTD	↓		↓		↓	↓
%TA				↓		↓
1st Year Size		↑	↑			
#Faculty		↑	↑	↑		
#Enrolled		↑	↑			
GRE			↑			
Belonging				↑		
%FacGrants				↑		
%FemStud				↓		
%MinStud				↓		
%RA				↓		
Ratio				↑		

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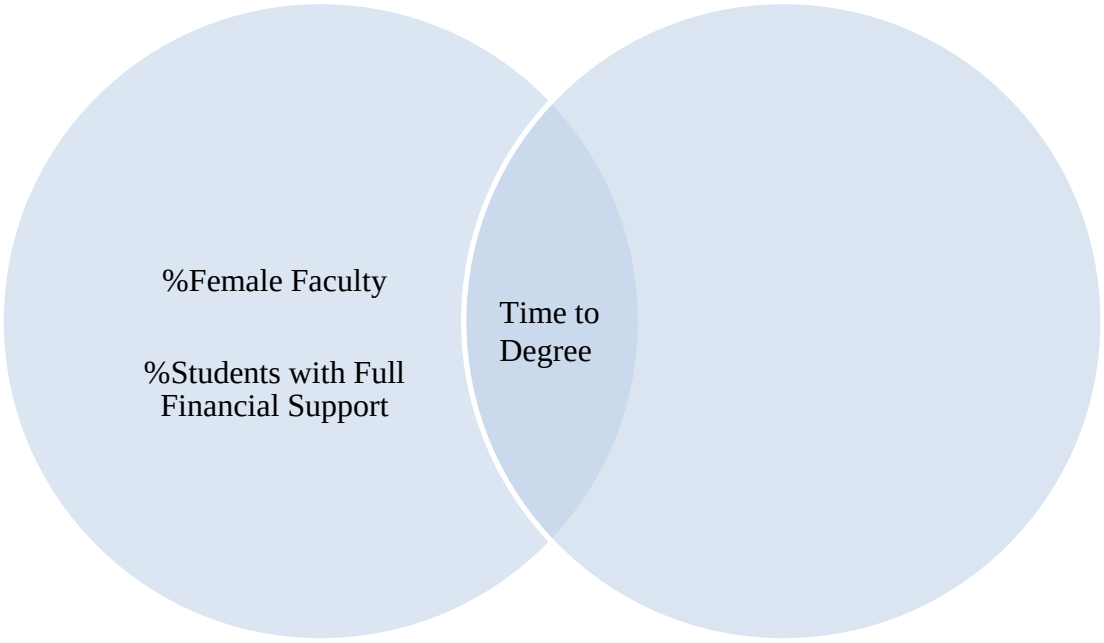

Figure 3: Significant Predictors of Completion (left circle) and Significant Differences between the High and Low-Completing Groups (right circle) in Neuroscience

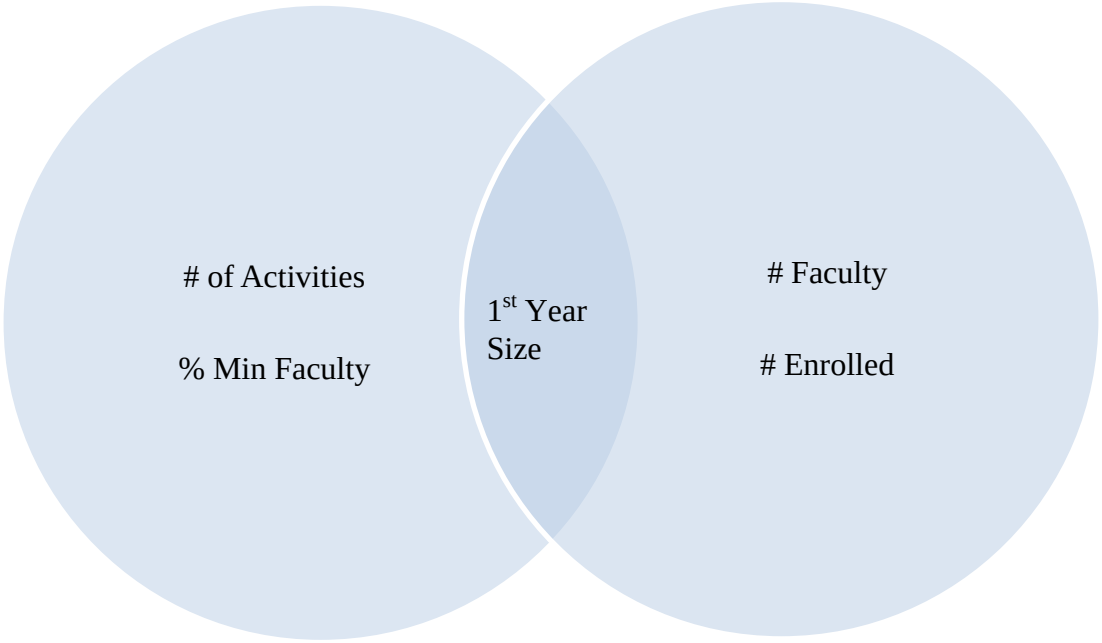

Figure 4: Significant Predictors of Completion (left circle) and Significant Differences between the High and Low-Completing Groups (right circle) in Chemical Engineering

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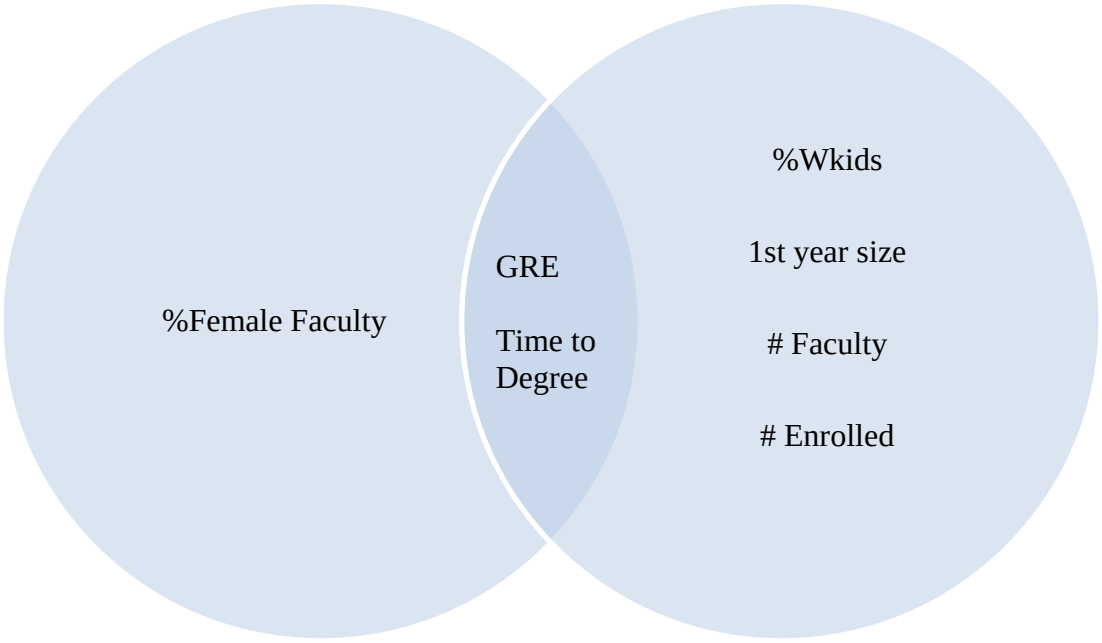

Figure 5: Significant Predictors of Completion (left circle) and Significant Differences between the High and Low-Completing Groups (right circle) in Physics

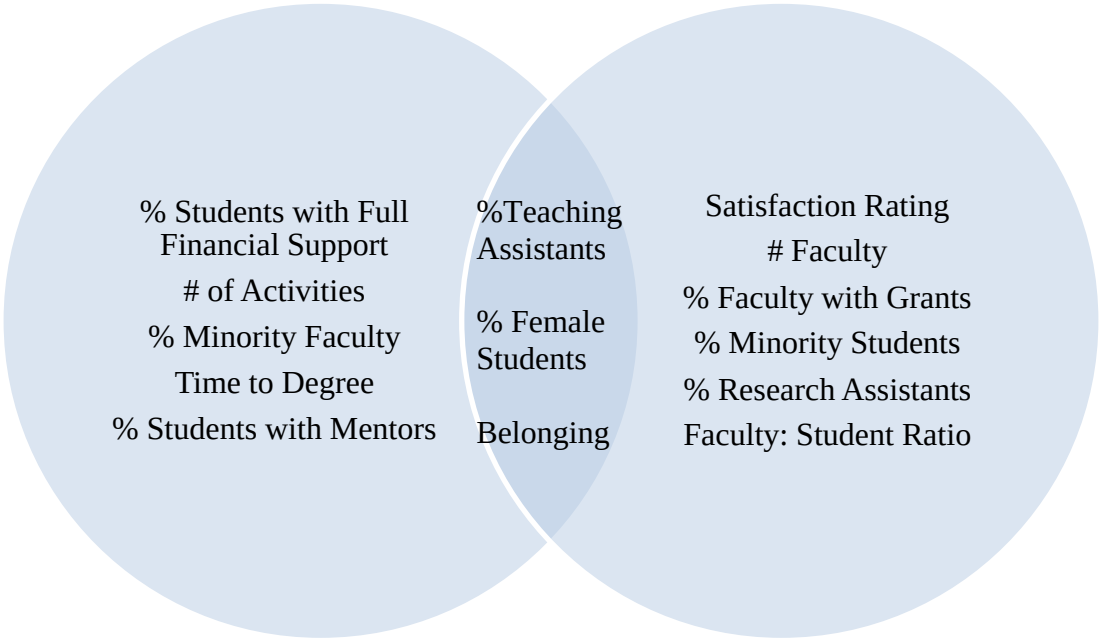

Figure 6: Significant Predictors of Completion (left circle) and Significant Differences between the High and Low-Completing Groups (right circle) in Economics

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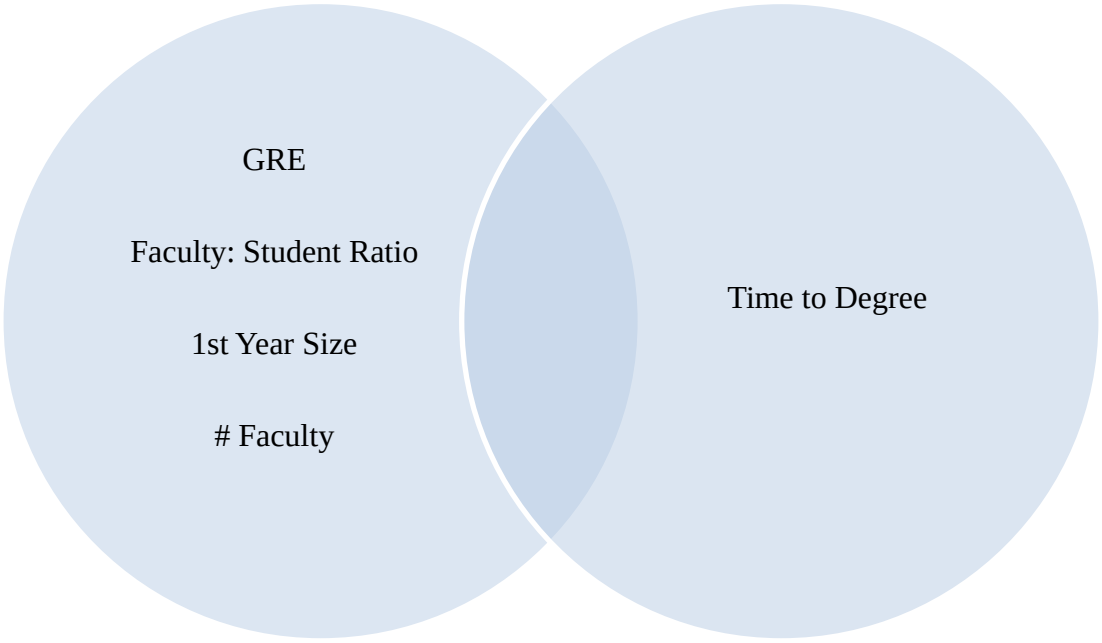

Figure 7: Significant Predictors of Completion (left circle) and Significant Differences between the High and Low-Completing Groups (right circle) in English

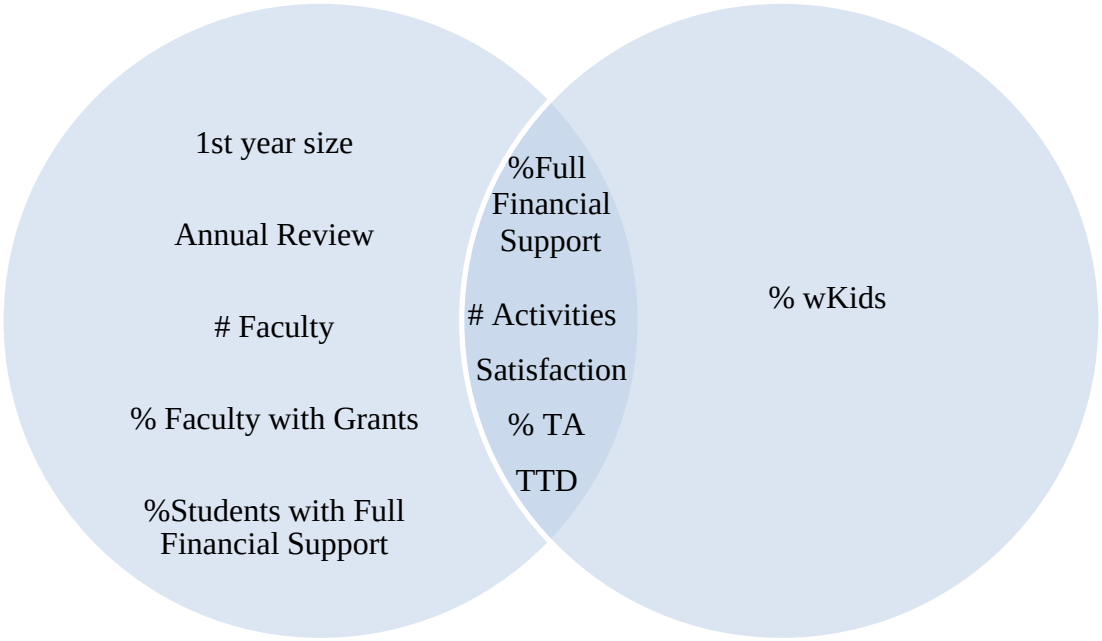

Figure 8: Significant Predictors of Completion (left circle) and Significant Differences between the High and Low-Completing Groups (right circle) in the All Programs group

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APPENDICES

APPENDIX A

Program Questionnaire (NRC)

National Research Council
2006 Assessment of Research Doctorate Programs

Program Questionnaire

Every ten or so years, the National Research Council conducts a study of national importance regarding the quality and characteristics of doctoral programs in the United States. This comparative assessment is designed to assist prospective doctoral students with selecting programs that best fit their interests and to permit programs to benchmark themselves against similar programs.

The 2006 Assessment of Research Doctorate Programs collects data about the doctoral programs in over 60 areas of study in American universities.

The information from your responses to this questionnaire will be compiled by Mathematica Policy Research and provided to the National Research Council for their analyses. The National Research Council staff who analyze the data will sign non-disclosure confidentiality agreements to protect the identity of individuals participating in this survey. Any information, including race/ethnicity and gender, that is not currently available to the public, will be treated as confidential and only reported in aggregated form so that it cannot be used to discern the identity of any survey participant in any report or presentation concerning the survey or in the public use file that will be made available to the public at the conclusion of this study.

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Appendix A (continued)

Your institution has identified your program in:

____(Name of program that was identified by the institution)_____

as an area of doctoral study that corresponds to the following field in the NRC taxonomy:

____(Name of field in the NRC taxonomy)_____

1) Your program was selected because it satisfies at least three of the following four criteria for a doctoral program:

1. Enrolls doctoral students
2. Has a designated faculty
3. Develops a curriculum for doctoral study
4. Makes recommendations for the award of degrees.

In addition, the program must have awarded 5 Ph.D.s during the period 2001/2 to 2005/6.

a. I believe my program may be ineligible ☐ *(go to IN1)*

2) The following other program(s) at your institution will also be part of the study in the field of_(Name of field in the NRC taxonomy):

____(Name of program that was identified by the institution)_____
____(Name of program that was identified by the institution)_____ etc.

3) If other doctoral degree-granting programs in this field exist at your institution (see above),
data and faculty lists for those programs will be provided to the NRC separately. *Consequently, please do not include faculty members in those programs here, unless they actively participate in your program.*

Part A. Program Fields and Research Specialties

In this section of the questionnaire, we collect information on the fields your program is associated with and the research specialties of your faculty.

***A0. Please enter the website address (URL) for this program. (e.g. www.myuniversity.edu/my program)**

_____

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Appendix A (continued)

A1. Is this program interdisciplinary in nature, drawing significantly on knowledge and techniques in two or more fields?

☐ *Yes*
☐ *No*

If not an engineering field, skip to Part B

A2. Although students accepted into this program may specialize in areas within engineering, does this program confer. . .

☐ *A general (or nonspecific) doctoral degree in engineering*
☐ *A doctorate in a specific engineering field such as mechanical engineering or biomedical engineering*

Part B. Program Faculty

Some institutions may find submitting this information easier in a spreadsheet format. If you would prefer using the Excel spreadsheet available from Mathematica, click on "Will use spreadsheet" below. You will be skipped to the next section in the questionnaire. Please submit the spreadsheet to Mathematica at your earliest convenience.

- *SPREADSHEETS WILL NOT BE ACCEPTED AFTER CLOSE OF BUSINESS DECEMBER 15, 2006.*

☐ *Will use spreadsheet*
☐ *Continue to the faculty section of the web survey*

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Appendix A (continued)
In this section, we ask you to provide information about your faculty in three categories—core, new, and associated.

B1. Core Faculty. Please complete the table below with the names of faculty members who:

1) have served as a chair or member of a program dissertation committee in the past 5 academic years (2001-2002 through 2005-2006), OR
2) are serving as a member of the graduate admissions or curriculum committee

The faculty member must be currently (2006-2007) and formally designated as faculty in the program, and not be an outside reader who reads the dissertation but does not contribute substantially to its development. Include emeritus faculty only if the faculty member has, within the past three years, either chaired a dissertation committee or been the primary instructor for a regular PhD course.

Information Collected	Answer Options
Name: *First : Middle Initial: *Last :	
Fields of Specialization: Primary : Secondary:	
Faculty Rank:	Professor Associate Professor Assistant Professor Emeritus Other, specify
Tenure status:	Tenured Nontenured, tenure-track Nontenured, non tenure-track
Highest degree:	Doctorate (e.g. PhD DSc EdD etc.) Other professional degree (e.g. JD LLB MD DDS DVM etc.) Master's degree (e.g. MS MA MBA) Other (specify)
Number of Dissertation Committees: *Chaired in this Program in the last five years (acted on as primary dissertation advisor) *Served on in this Program in the Last Five Years (include Committees Served on as a member or chair)	

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Appendix A (continued)

Gender:	Male Female
Citizenship:	U.S. Citizen Permanent Resident Temporary Visa Holder Unknown
Race/Ethnicity:	White, Non-Hispanic Black, Non-Hispanic Hispanic Asian or Pacific Islander American Indian or Alaska Native Race/Ethnicity Unknown
University Address: *Line 1: Line 2: *City *State *Zip Code	
*Telephone	
*Email	

*=Required fields

B2. <u>New Faculty</u>. Please complete the table below with the names of faculty members not listed as core in the previous questions who:

1) do not meet the criteria for core faculty, but who have been hired in tenured or tenure-track positions within the past three academic years (2003-2004 through 2005-2006) AND

2) are currently employed at your university and are expected to become involved in doctoral education in your program.

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Appendix A (continued)

Information Collected	Answer Options
Name: *First : Middle Initial: *Last :	
Fields of Specialization: Primary : Secondary:	
Faculty Rank:	Professor Associate Professor Assistant Professor Emeritus Other, specify
Tenure status:	Tenured Nontenured, tenure-track Nontenured, non tenure-track
Highest degree:	Doctorate (e.g. PhD DSc EdD etc.) Other professional degree (e.g. JD LLB MD DDS DVM etc.) Master's degree (e.g. MS MA MBA) Other (specify)
Gender:	Male Female
Citizenship:	U.S. Citizen Permanent Resident Temporary Visa Holder Unknown
Race/Ethnicity:	White, Non-Hispanic Black, Non-Hispanic Hispanic Asian or Pacific Islander American Indian or Alaska Native Race/Ethnicity Unknown
University Address: *Line 1: Line 2: *City *State *Zip Code	
*Telephone	
*Email	

*=Required fields

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Appendix A (continued)

B3. <u>Associated Faculty</u>. Please complete the table below with the names of faculty members who:

1) have chaired or served on program dissertation committees in the past five years (2001 2002 through 2005-2006), AND

2) have a current (2006-2007) appointment at your institution, but who are not designated faculty in the program.

They should not be outside readers, or faculty currently employed at other universities, unless they are on leave from the faculty at your institution. Include emeritus faculty only if the faculty member has, within the past three years, either chaired a dissertation committee or been the primary instructor for a regular PhD course.

Information Collected	Answer Options
Name: *First : Middle Initial: *Last :	
Fields of Specialization: Primary : Secondary:	
Faculty Rank:	Professor Associate Professor Assistant Professor Emeritus Other, specify
Tenure status:	Tenured Nontenured, tenure-track Nontenured, non tenure-track
Highest degree:	Doctorate (e.g. PhD DSc EdD etc.) Other professional degree (e.g. JD LLB MD DDS DVM etc.) Master's degree (e.g. MS MA MBA) Other (specify)
Number of Dissertation Committees: *Chaired in this Program in the last five years (acted on as primary dissertation advisor) *Served on in this Program in the Last Five Years (include Committees Served on as a member or chair)	

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Appendix A (continued)

Gender:	Male Female
Citizenship:	U.S. Citizen Permanent Resident Temporary Visa Holder Unknown
Race/Ethnicity:	White, Non-Hispanic Black, Non-Hispanic Hispanic Asian or Pacific Islander American Indian or Alaska Native Race/Ethnicity Unknown

*=Required fields

B5. The next question(s) collect aggregate information on faculty diversity. The total number of core and new faculty for this program was provided by this institution.

How many of the approximately *[number of faculty from spreadsheet]* **core and new faculty members in this program are . . .**

If none, enter as 0

☐ Male
☐ Female

B6. The next question(s) collect aggregate information on faculty diversity. The total number of core and new faculty for this program was provided by this institution.

How many of the approximately *[number of faculty from spreadsheet]* **core and new faculty members in this program are . . . .**

If none, enter zero

U.S. Citizens: ☐☐☐
Permanent Residents: ☐☐☐
Temporary Visa Holders: ☐☐☐
Citizenship Unknown: ☐☐☐

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Appendix A (continued)

***B7. The next question(s) collect aggregate information on faculty diversity. The total number of core and new faculty for this program was provided by this institution.**

Of the core and new faculty members in the program who are U.S. citizens or permanent residents, how many are:

If none, enter zero

White, Non-Hispanic:	☐
Black, Non-Hispanic:	☐
Hispanic:	☐
Asian or Pacific Islander:	☐
American Indian or Alaska Native:	☐
Race/Ethnicity Unknown:	☐

[Program will check to make sure the total of responses to this question equals the numbers entered for U.S. citizens and permanent residents in B6.]

B8. Is the dissertation committee chair typically the primary advisor of doctoral students in your program?

☐ Yes
☐ No

Part C. Doctoral Program: Enrollment and Degree Completion

In this section, we ask for information about your program's doctoral students and degree recipients, including demographic information, enrollments, and degrees awarded.

***C1. For each academic year listed below, please indicate the number of doctoral degrees awarded in your program that year.**

	Number of Doctoral Degrees Awarded
If none: enter zero	
2001-2002	☐☐☐
2002-2003	☐☐☐
2003-2004	☐☐☐
2004-2005	☐☐☐
2005-2006	☐☐☐

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Appendix A (continued)

***C2. Of the doctoral graduates who received doctoral degrees in the period 2003-2004 through 2005-2006, what was the <u>median time to degree?</u>**

- The median is the mid-point measured from the date of first enrollment in the program to date of graduation—50 percent took a shorter time to complete their degrees and 50 percent took longer
- When entering a number that includes a decimal, please type the decimal
- If this program enrolls MD/PhD students and the time to degree for these students can be calculated separately, do NOT include these students below. You will be asked about the MD/PhD students later.

	Median Number of Years
a. All full-time and part-time doctoral students	|__| . |__|
b. Doctoral students who were full-time during their entire time in the program	|__| . |__|

C3. For each academic year listed below, please indicate:

1) The number of doctoral students to whom your program <u>offered admission</u> AND
2) The number of doctoral students who then <u>enrolled</u> for the first time.

	Number Offered Admission *If none: enter zero*	*Number First-Time Enrolled* *If none: enter zero*
2001-2002	☐☐☐	☐☐☐
2002-2003	☐☐☐	☐☐☐
2003-2004	☐☐☐	☐☐☐
2004-2005	☐☐☐	☐☐☐
2005-2006	☐☐☐	☐☐☐

[The program will check that for each row, the number entered in col 1 must be larger that the number entered in col 2.]

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Appendix A (continued)

C4. What is your program's policy regarding whether a master's degree in the field is required prior to admission to this program:

Mark one only

☐ It is required prior to admission

☐ It is expected that students will earn it as a stage in their doctoral program

☐ Neither of the above

C5. Of the *[program automatically calculates number from response to question C3]* **students who enrolled for the first-time in 2003-2004, 2004-2005, and 2005-2006, what number had a master's degree <u>in the field of your program</u> prior to enrollment?**

If not known: check this box: ☐ *and continue*

If none: enter zero

Number of students: ☐☐☐

[The program will check that the number entered must be equal to or smaller than the total number of students in col 2 for years 2003-2006 in C3.]

C6. Does your doctoral program have a continuous enrollment policy?

- ***Continuous Enrollment*** *means that a person is considered to be a doctoral student only if he or she is enrolled and pays tuition or a fee. Under this policy, a student who drops out must apply for reinstatement.*

☐ Yes
☐ No skip to C8

C7. To whom does this policy apply?

Mark one only

☐ All Students
☐ Students Admitted to Candidacy
☐ Other (Specify _____)

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Appendix A (continued)

C8. How many doctoral students, whether or not they were yet admitted to candidacy, were enrolled in your program during fall of 2005?

Number of Doctoral
Students Enrolled Fall 2005: ☐☐☐

C9. Of the *[program automatically enters the number from C8]* **doctoral students enrolled in your program during the fall of 2005, how many were …**

If none: enter zero

Male: ☐☐☐
Female: ☐☐☐

[Program will check to make sure the total of responses to this question equal the numbers entered for total in C8.]

a. Of the *[program automatically enters the number from C8]* **doctoral students enrolled in your program during the fall of 2005, how many were enrolled. . .**

If none: enter zero

Full-Time: ☐☐☐
Part-time: ☐☐☐

[Program will check to make sure the total of responses to this question equal the numbers entered for total in C8]

b. Of the *[program automatically enters the number from C8]* **doctoral students enrolled in your program during the fall of 2005, how many were …**

If none: enter zero

U.S. Citizens: ☐☐☐
Permanent Residents: ☐☐☐
Temporary Visa Holders: ☐☐☐
Citizenship Unknown: ☐☐☐

[Program will check to make sure the total of responses to this question equal the numbers entered for total in C8.]

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Appendix A (continued)

***c. Of the** *[program enters the number of US citizens and permanent residents from C9b]* **doctoral students who were U.S. citizens or permanent residents, how many were…**

	If none: enter zero
White, Non-Hispanic:	☐☐☐
Black, Non-Hispanic:	☐☐☐
Hispanic:	☐☐☐
Asian or Pacific Islander:	☐☐☐
American Indian or Alaska Native:	☐☐☐
Race/ethnicity Unknown:	☐☐☐

[Program will check to make sure the total of responses to this question equal the numbers entered for U.S. citizens and permanent residents in C9b.]

C10. Does this program enroll dual professional degree/PhD students?

Dual professional degree/PhD students include students such as MD/PhD, DVM/PhD or ThD/PhD students.

☐ Yes
☐ No

If no, skip to C12

a. How many dual professional degree /PhD students were enrolled in this program in Fall 2005?

Dual professional degree/PhD students include students such as MD/PhD, DVM/PhD or ThD/PhD students.

If none: enter zero

Number of **dual professional degree**/PhD Students |_____|

b. Does this program include only dual professional degree /PhD students?

Dual professional degree/PhD students include students such as MD/PhD, DVM/PhD or ThD/PhD students.

☐ Yes *(skip to C12)*
☐ No *(go to C10c)*

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Appendix A (continued)

c. How will you be reporting the progress of the dual professional degree /PhD students enrolled in this program?

Dual professional degree/PhD students include students such as MD/PhD, DVM/PhD or ThD/PhD students.

☐ Can report separately on the dual professional degree/PhD students
☐ Cannot report separately on the dual professional degree/PhD students (*skip to C12)*

***C11. What was the median time to degree for students enrolled in the dual professional degree/PhD segment of this program who graduated in the period 2003-2004 through 2005-2006?**

Dual professional degree/PhD students include students such as MD/PhD, DVM/PhD or ThD/PhD students.

- *The median is the mid-point measured from the date of first enrollment in the program to date of graduation—50 percent took a shorter time to complete their degrees and 50 percent took longer*
- *When entering a number that includes a decimal, please type the decimal.*

	Median Number of Years
All full-time and part-time dual professional degree/PhD graduates	|__| . |__|
dual professional degree/PhD graduates who were full-time during their entire time in the program	|__| . |__|

C12. Please describe how your program defines a full-time doctoral student:

_____
_____
_____

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Appendix A (continued)

C13. Does your program have formal requirements for being admitted to candidacy?

☐ Yes
☐ No skip to C15

C14. Please indicate the criteria your program uses to admit students to candidacy.

Mark all that apply

☐ Successful Completion of Required Coursework
☐ Successful Completion of Written Examination(s)
☐ Successful Completion of Oral Examination(s)
☐ Award of the Master's Degree
☐ Defense of a Dissertation Prospectus
☐ Other Specify:_____

C15. During the 10 years between 1996 and 2005, did your program distinguish between students seeking a master's and those seeking a doctorate?

Mark one only

☐ Yes, distinguished between seeking a master's and seeking a doctorate during that entire time period → skip to C16

☐ Began that period making the distinction but later changed

☐ Began that period making no distinction but later changed

☐ No, made no such distinction during that entire period → skip to C16

C15a. In what year did the policy change?

Year:☐☐☐☐

C16.The next series of questions collects information on how many of the full-time students in your program complete doctoral study by gender.

[*FILL if C10c = "can report separately*
Since you will be reporting them separately, please do NOT include the program's dual professional degree/PhD students in the numbers reported for questions C16a through C17b

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Appendix A (continued)

[*FILL if C10c = "cannot report separately"*
Please include the program's dual professional degree/PhD students in the numbers reported for questions C16a through C17b

- To preserve confidentiality, if the numbers in cells equal less than 5, the NRC will aggregate over cohorts so that the size of any reported cell is always greater than or equal to 5
- Include doctoral students enrolled in your doctoral program, whether or not they have been admitted to candidacy
- Do not include students who only enroll with the intent of earning a master's degree and did not convert to doctoral students.
- Doctoral students who "left the program" are those who are no longer enrolled at this time.
- Doctoral students who "stopped out" (left but later enrolled again) should not be counted as students who left if they are currently enrolled or completed the doctoral degree
- Admitted to Candidacy may be defined in different ways. If your program defines and grants candidacy for a doctoral degree, please use the definition of admitted to candidacy your program uses. If it does not, please leave column 4 (Number of students admitted to doctoral candidacy) blank.
- Since you will be reporting them separately, please do NOT include the program's dual professional degree/PhD students in the numbers reported for questions C16a through C17b.

C16a. Please complete the table for the male students in your program

	Number of entering doctoral students If none: enter zero	Number of students who left the program without a master's or doctoral degree	Number of students who left the program after receiving a master's degree	Number of students admitted to doctoral candidacy
1996-1997				
1997-1998				
1998-1999				
1999-2000				
2000-2001				
2001-2002				
2002-2003				
2003-2004				
2004-2005				
2005-2006				

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Appendix A (continued)

***C16b. Of the male students admitted to candidacy in your program, record the number who within the various time spans listed below completed doctoral degrees within the given number of years after enrolling.**

	3 years or less	4 years	5 years	6 years	7 years	8 years	9 years	10 years
1996-1997								
1997-1998								
1998-1999								
1999-2000								
2000-2001								
2001-2002								
2002-2003								
2003-2004								
2004-2005								
2005-2006								

***C17a. Please complete the table for the female students in your program**

	Number of entering doctoral students If none: enter zero	Number of students who left the program without a master's or doctoral degree	Number of students who left the program after receiving a master's degree	Number of students admitted to doctoral candidacy
1996-1997				
1997-1998				
1998-1999				
1999-2000				
2000-2001				
2001-2002				
2002-2003				
2003-2004				
2004-2005				
2005-2006				

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Appendix A (continued)

***C17b. Of the female students admitted to candidacy in your program, record the number who within the various time spans listed below completed <u>doctoral</u> degrees <u>within</u> the given number of years after enrolling.**

	3 years or less	4 years	5 years	6 years	7 years	8 years	9 years	10 years
1996-1997								
1997-1998								
1998-1999								
1999-2000								
2000-2001								
2001-2002								
2002-2003								
2003-2004								
2004-2005								
2005-2006								

Ask C18a and C18b if C10c = can report separately

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Appendix A (continued)

C18a. Please complete the table for the dual professional degree/PhD students in this program.

Dual professional degree/PhD students include students such as MD/PhD, DVM/PhD or ThD/PhD students.

	Number of entering doctoral students If none: enter zero	Number of students who left the program without a master's or doctoral degree	Number of students who left the program after receiving a master's degree	Number of students admitted to doctoral candidacy
1996-1997				
1997-1998				
1998-1999				
1999-2000				
2000-2001				
2001-2002				
2002-2003				
2003-2004				
2004-2005				
2005-2006				

***C18b. Of the dual professional degree/PhD students admitted to candidacy in your program, record the number who within the various time spans listed below completed doctoral degrees within the given number of years after enrolling.**

Dual professional degree/PhD students include students such as MD/PhD, DVM/PhD or ThD/PhD students.

	3 years or less	4 years	5 years	6 years	7 years	8 years	9 years	10 years	Delete col
1996-1997									
1997-1998									
1998-1999									
1999-2000									
2000-2001									

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Appendix A (continued)

2001-2002									
2002-2003									
2003-2004									
2004-2005									
2005-2006									

C19. In order to analyze program interdisciplinarity through a review of dissertation key words, please enter the full names of every student who was awarded a doctoral degree in this program over the past three years (2003-04 through 2005-06) and the academic year in which that degree was awarded.

Enter each student's name and the academic year on each line

First Name	**Middle**	**Last Name**	**Academic Year**
_____		_____	_____
_____		_____	_____
_____		_____	_____
			[allow 300]

Part D. Doctoral Program: Characteristics

In this section, we ask for information about the characteristics of your doctoral program.

D1. Did you require GREs from all students entering this doctoral program in 2005-2006?

Mark one only

☐ Yes, required for all (*skip to D4)*
☐ No, only required for some
☐ No, not required for any (*skip to D5)*

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Appendix A (continued)

D2. Which of the following criteria are used to exempt students from the GRE requirement?

M*ark all that apply*

- ☐ Professional experience
- ☐ Master's degree
  - ☐ Undergraduate degree from same institution
  - ☐ Graduate degree from same institution
  - ☐ High undergraduate GPA
  - ☐ Publications or research experience
  - ☐ Not required for international students
  - ☐ Other exam (e.g., LSAT, GMAT) (Specify, _____)

D3. When applying for admission, do more than 50 percent of the entering students in your program provide GRE scores?

☐ Yes
☐ No *skip toD5*

D4. Among the doctoral students enrolling for the first time in the program, please enter, for each academic year:

1) The number who reported their scores
2) Their median Verbal GRE
3) Their median Quantitative GRE scores

	2003-04	**2004-05**	**2005-06**
1) Number of GRE test takers			
2) Median score, Verbal GRE			
3) Median score, Quantitative GRE			

[Program will check D4(1)to make sure the numbers are less than or equal to the numbers in C3, col b]

D5. Does your program require all (or most) doctoral students to serve as teaching assistants (TAs), as part of their doctoral experience?

☐ Yes
☐ No skip to question D7

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Appendix A (continued)

D6. For how many terms are they required to TA?

If none: enter zero
Number of Terms Required: ☐☐

D7. Among doctoral students who teach in return for their stipend or salary…

a. In the fall of 2005, how many doctoral students in this program were assigned to <u>assist faculty</u> by teaching lab or recitation sections?

If none: enter zero
Number of Students: ☐☐☐

b. On average, <u>how many course sections</u> do doctoral students who assist faculty by teaching lab or recitation sections teach in a given term?

If none: enter zero
Number of Course Sections: ☐

c. In the fall of 2005, how many doctoral students were appointed with <u>sole responsibility</u> for instruction of one or more courses or course sections?

If none: enter zero
Number of Students
With Sole Responsibility: ☐☐☐

d. On average, <u>how many course sections</u> do those doctoral students with sole responsibility for instruction teach?

If none: enter zero
Number of Course Sections: ☐

e. On average, <u>how many students are enrolled</u> in classes taught by doctoral students with sole responsibility for their instruction?

If none: enter zero
Number of students enrolled: ☐☐☐

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Appendix A (continued)

D8. Please indicate whether your institution and/or your program provides the following kinds of support for doctoral students or doctoral education.

	Institutional Support Only	Program Support Only	Both Institutional and Program Support	Neither Institutional nor Program Support
Orientation for new graduate students	☐	☐	☐	☐
International student orientation	☐	☐	☐	☐
Language screening/support prior to teaching	☐	☐	☐	☐
Instruction in writing (outside of program requirements)	☐	☐	☐	☐
Instruction in statistics (outside of program requirements)	☐	☐	☐	☐
Prizes/awards to doctoral students for teaching and/or research	☐	☐	☐	☐
Assistance/training in proposal preparation	☐	☐	☐	☐
On-campus, graduate student research conferences	☐	☐	☐	☐
Formal training in academic integrity/ethics	☐	☐	☐	☐
Active graduate student association	☐	☐	☐	☐
Staff assigned to the graduate student association	☐	☐	☐	☐
Financial support for the graduate student association	☐	☐	☐	☐
Posted academic grievance procedure	☐	☐	☐	☐
Dispute resolution procedure	☐	☐	☐	☐
Regular graduate program directors/coordinators meetings	☐	☐	☐	☐
Annual review of all enrolled doctoral students	☐	☐	☐	☐
Organized training to help students improve teaching skills	☐	☐	☐	☐
Travel support to attend professional meetings	☐	☐	☐	☐

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Appendix A (continued)

D9. Does your program confer awards to honor faculty for mentoring or other activities that promote scholarship of doctoral students?

☐ Yes
☐ No

D10. Does your program collect data about employment outcomes for all of your doctoral graduates?

☐ Yes
☐ No skip to question D12

D11. Do you provide potential applicants with this information?

☐ Yes
☐ No

D12. Approximately what percentage of the doctoral students in your program have a workspace for their <u>exclusive use</u>? (For example: a carrel in the library, a desk in an office or other place where they can keep books, papers and materials)

If none: enter zero

Percentage with exclusive work space: ☐☐☐%

D13. Please list the interdisciplinary centers, programs, or clinics in which the greatest number of doctoral students from your program participate (conduct research, teach, or gain clinical experience). Please list no more then 10.

If none: check this box: ☐ *and continue*

NAMES OF INTERDISCIPLINARY CENTERS, PROGRAMS, OR CLINICS:

_____

[allow 10]

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Appendix A (continued)

D14. What other programs does your program collaborate with for organized training activities (e.g. training grants, certificate programs, joint degree programs)?

If none: check this box: ☐ *and continue*

NAMES OF OTHER PROGRAMS

_____
_____
_____

[allow 10]

Part E. Doctoral Program: Financial Support for Full -Time Students

In this section, we ask for information about the financial support your program provides to its full-time doctoral students.

E1. For the 2005-2006 academic year, what did your institution charge full-time first-year doctoral students in your program for tuition, mandatory fees, and health insurance premiums?

- *Enter dollar amounts without commas or dollar signs ($).*
- *Public Institutions: Please answer separately for in-state and out-of-state students*

	Public Institutions		**Private Institutions**
	In-state students	Out-of-state students	
Tuition and fees for full-time enrollment:	$_____	$_____	$_____
Health Insurance premiums:	$_____	$_____	$_____

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Appendix A (continued)

E2. For the 2005-2006 academic year, not including summer 2006, what was the <u>modal amount of total financial support</u> your program provided to funded full-time first-year doctoral students?

- *Financial support is funding provided by your institution or program or by an external funding agency or organization. It does not include personal, spousal, or family support, wages from work unrelated to the program, or loans*
- *Enter dollar amounts without commas or dollar signs ($).*
- *Public Institutions: Please answer separately for in-state and out-of-state students.*

	Public Institutions		Private Institutions
	In-state students	Out-of-state students	
Modal Amount Of Total Support	$_____	$_____	$_____

E3. For the 2005-2006 academic year, not including summer 2006, what was the <u>modal amount of financial support</u> your program provided to funded full-time first-year doctoral students in these three categories?

- *Enter dollar amounts without commas or dollar signs ($).*
- *Public Institutions: Please answer separately for in-state and out-of-state students*

	Public Institutions		Private Institutions
	In-state students	Out-of-state students	
Tuition and fees for full-time enrollment:	$_____	$_____	$_____
Health Insurance premiums:	$_____	$_____	$_____
Academic year support (stipend/salary)	$_____	$_____	$_____

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Appendix A (continued)

E4. What was the modal amount of summer 2006 support your program provided to funded full-time first-year doctoral students?

If none: check this box ☐ and continue

- *Enter dollar amounts without commas or dollar signs ($).*
- *Public Institutions: Please answer separately for in-state and out-of-state students.*

	Public Institutions		Private Institutions
	In-state students	Out-of-state students	
Summer support:	$_____	$_____	$_____

E5. How many of the <u>full-time first-year</u> doctoral students (FFDs) who entered your program in the 2005-06 academic year had…..

	Number of Students *If none: enter zero*
Full financial support:	☐☐☐
Partial financial support:	☐☐☐
No financial support:	☐☐☐
Total number of FFD doctoral students:	☐☐☐

[Program will check that the first three numbers add to the last number]

E6. Does a majority of the full-time doctoral students in your program receive a typical pattern of financial support over their first five years?

☐ Yes
☐ No *skip to E8*

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Appendix A (continued)

E7 Please indicate your program's typical five-year pattern of financial support by recording, for each funding mechanism listed, how many years of support a student would typically receive during his or her first five years of enrollment.

- *For the types of support that are not applicable, enter 0*
- *When entering a number that includes a decimal, please type in the decimal.*

	Typical Five-Year Pattern
Number of fellowship support years:	☐.☐
Number of traineeship support years:	☐.☐
Number of teaching assistantship years:	☐.☐
Number of research assistantship years:	☐.☐
Number of other assistantship years:	☐.☐
Number of years without support:	☐.☐

E8. Including all of the *[program automatically enters the number from C9a (full-time)]* **Fall term 2005 full-time doctoral students, record the number who received the various types of support indicated below:**

- ***Financial support*** *is funding provided by your institution or program or by an external funding agency or organization. It does not include personal, spouse, or family support, wages from work unrelated to the program, or loans*

Fall Term 2005 Doctoral Students by Year in Program

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	>6 Yr
Full support							
a) Externally funded fellowships only							
b) Externally funded traineeships only							
c) Institutional fellowships only							
d) Teaching assistantships only							
e) Research assistantships only							
f) Administration (other) assistantship only							
g) Combination of externally funded fellowship or traineeship (a or b) with internal support (c, d, e, and/or f)							
h) Combination of internal fellowship(s) with internal assistantships (d, e, and/or f)							
i) Combination of internal assistantships (d, e, and/or f)							
___ j) Other _____							
Funded with less than full support							
Unfunded							
TOTAL NUMBER OF STUDENTS							

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Appendix A (continued)

E9. During the 2005-2006 academic year, did your program use externally-funded <u>training grants</u> to support doctoral students?

☐ Yes
☐ No

Part F. Postdoctoral Scholars

In this section, we ask for information about the postdoctoral scholars (postdocs) associated with your program

*Please use this **definition of a postdoctoral scholar** developed by the Association of American Universities:*

- *The appointee was recently awarded a Ph.D. or equivalent doctorate (e.g., Sc.D., M.D.) in an appropriate field; and*
- *the appointment is temporary; and*
- *the appointment involves substantially full-time research or scholarship; and*
- *the appointment is viewed as preparatory for a full-time academic and/or research career; and*
- *the appointment is not part of a clinical training program; and*
- *the appointee works under the supervision of a senior scholar or a department in a university or similar research institution (e.g., national laboratory, NIH, etc.); and*
- *the appointee has the freedom, and is expected, to publish the results of his or her research or scholarship during the period of the appointment.*

(See: http://www.aau.edu/reports/PostDocRpt.html. Accessed 6/27/06)

F1. During the 2005 Fall term, were any postdoctoral scholars, including those who are university employees or those on external or portable fellowships, working with core or new faculty in your program?

☐ Yes
☐ No *skip to exit screen*

F2. During the 2005 Fall term, how many postdoctoral scholars, including those who are university employees or those on external or portable fellowships, were working with core or new faculty in your program?

Number of Postdocs: ☐☐☐

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Appendix A (continued)

a. Of the [program enters the number from F2] **postdoctoral scholars, how many were …**

Male: ☐☐☐
Female: ☐☐☐

[Should total to the number in F2]

b. Of the *[program enters the number from F2]* **postdoctoral scholars, how many were …**

	If none: enter zero
U.S. Citizens:	☐☐☐
Permanent Residents:	☐☐☐
Temporary Visa Holders:	☐☐☐
Citizenship Unknown:	☐☐☐

[Should total to the number in F2]

c. Of the *[program enters the number of US citizens and permanent residents from F2b]* **postdoctoral students who were U.S. citizens or permanent residents, how many were…**

	If none: enter zero
White, Non-Hispanic:	☐☐☐
Black, Non-Hispanic:	☐☐☐
Hispanic:	☐☐☐
Asian or Pacific Islander:	☐☐☐
American Indian or Alaska Native:	☐☐☐
Race/ethnicity Unknown:	☐☐☐

[Program will check to make sure the total of responses to this question equal the numbers entered for U.S. citizens and permanent residents in F2b]

F3. Among the *[program enters the number from F2]* **postdoctoral scholars associated with this program, which four countries of origin provide the largest percentage of postdoctoral scholars on temporary visas to the program and what percentage of all postdoctoral scholars in the program do citizens of these countries comprise?**

Country of Origin	**Percentage of All Postdoctoral Scholars in the Program**
_____	☐☐%
_____	☐☐%
_____	☐☐%
_____	☐☐%

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Appendix A (continued)

F4. Of the *[program enters the number from F2]* **postdoctoral scholars associated with this program, how many had <u>portable fellowships</u> (i.e., fellowships awarded directly to postdoctoral scholars rather than through institutions and which can be used at an institution of the individual's choosing)?**

If none: enter zero

Please fill in number: ☐☐☐

Part IN: Possible Ineligible Program

IN1. Is this program ineligible because it:

Mark All That Apply

☐ a. Does NOT enroll doctoral students?
☐ b. Does NOT have designated faculty?
☐ c. Has NO developed curriculum for doctoral study?
☐ d. Makes NO recommendations for the award of degrees?
☐ e. Awarded fewer than 5 Ph.D.s between 2001/2 to 2005/6?

[If "e" is marked, go to exit screen.]
[If "e" is not marked and there is only one item marked in a-d, go to 2.]

IN2. According to the eligibility criteria for the 2006 NRC Assessment, your program is eligible and you may continue.

[Return to eligibility page of questionnaire.]

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APPENDIX B

Faculty Questionnaire (NRC)

Welcome to the National Research Council's

2006 Assessment of Research Doctorate Programs
Faculty Questionnaire

Every ten or so years, the National Research Council conducts a study of national importance regarding the quality and characteristics of doctoral programs in the United States. The **2006 Assessment of Research Doctorate Programs** collects data on the doctoral programs and doctoral faculty in over 60 areas of study in American universities, along with some student data. This comparative assessment, the most comprehensive to date, is designed to assist prospective doctoral students with selecting programs that best fit their interests and to permit programs to benchmark themselves against similar programs.

Your participation is important. By completing this questionnaire, you are providing information that will: 1) help the NRC identify the characteristics of successful graduate programs, 2) enable the NRC with collecting data on grants, citations, and publications from other sources; and 3) permit a statistical description of the faculty in the graduate program(s) or programs with which you are affiliated. For further information about the assessment, see www7.nationalacademies.org/resdoc/index.html. This site also has a list of Frequently Asked Questions and contains an Email link to request answers to questions you might have concerning the study or the questionnaire.

All of the information you provide will be treated as confidential. The survey is being conducted by Mathematica Policy Research (MPR), an organization experienced in the conduct of confidential surveys. Your responses will be compiled by MPR and provided to the NRC for their analyses. Personally identifiable information, such as past employment and ZIP Codes, will be used to obtain data on publications, grants and awards and honors from other databases. The National Research Council staff who analyze the data will sign non-disclosure confidentiality agreements to protect the

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Appendix B (continued)

identity of individuals participating in the survey. The survey will be conducted using secure web-based survey technology and any information that could be used to identify or link responses to an individual respondent for any survey question will be maintained in storage that is secure. Any data, including race/ethnicity and gender, that is not currently available to the public will only be used in an aggregated form that cannot be used to discern the identity of any survey participant in any report or presentation concerning the survey or in the public use file that will be made available to the public at the conclusion of this study. The link between your name and the data you provide in this questionnaire will only be used to obtain publications and, awards and honors data from other databases and will be removed prior to the publication of the public use file.

Your participation is voluntary. Completing the questionnaire averages about 14 minutes, not counting the time required to list or upload publications, which will vary from person to person. You may refuse to answer any question or discontinue participation at any point. There is no personal risk to you in responding to this questionnaire. Your identity will be known to only the National Research Council and Mathematica Policy Research. No information concerning respondents will be given to your institution. If you have any questions about the study or this questionnaire, please email us at NRC-Assessment@mathematica-mpr.com. Faculty must submit their competed questionnaire by February 15, 2007 if they wish to be considered as a program rater for the Rating Survey that follows this spring. Otherwise, the end date is April 1, 2007.

Click here to indicate your informed consent to participate in this study ☐

A. Program Identification

You have been identified by your institution as a faculty member who participates in doctoral education in one or more graduate programs that fall under one or more fields in the NRC taxonomy. The names of these programs are listed below in questions A2i and A2. However, if you are involved in a doctoral program that is not on this list, it is not part of this study and should not be considered when responding to this questionnaire.

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Appendix B (continued)

A1. In what year did you become a faculty member at this institution?

Year: ☐☐☐☐

a. Do you have emeritus status?

☐ Yes (*ask A1b)*
☐ No (skip to *A2)*

b. During the last 3 years have you been the primary instructor for a regular PhD course?

☐ Yes
☐ No

A2i. Using the drop down list of graduate programs at this institution that are eligible for this study, please select the doctoral program or programs in which you are involved. <u>Do not include</u> programs for which you serve/ have served as an "outside reader."

For each please enter the number of doctoral dissertation committees you have <u>chaired</u> (that is, been the principal advisor for) during your last 3 years at this institution.

Do Not include committee memberships in programs that are not part of the study.

Program Name (Drop down list of institution's participating program)	**Number of Committees Chaired** *If none, enter zero*
_____	_____

[If A1b = yes, skip to A4]
[If A1b = no and A2i (Number of committees chaired) is > zero, skip to A4]
[If A1b = no and A2i (Number of committees chaired) is < zero, go to exit screen]

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Appendix B (continued)

A2. Using the drop down list, please select the doctoral program or programs in which you are involved. Do not include programs for which you serve/ have served as an "outside reader". For each please enter:

- *Column 1: The number of doctoral dissertation committees you have chaired (that is, been the principal advisor for) during your last 5 years at this institution*
- *Column 2: The total number of committees that you have either served on or chaired during the period 2001-2006. Please include committees on which you are currently serving or chairing*

Program Name (Drop down list of institution's participating program)	Column 1 **Number of Committees Chaired** *If none, enter zero*	Column 2 **Number of Committees Served On or Chaired** *If none, enter zero*
_____	_____	_____

(If A1 = 2003 or later or A2 contains a number greater than zero, skip to A4, otherwise ask A3)

A3. Are you currently serving on doctoral admissions or curriculum committees in one or more of the programs you indicated? [LIST PROGRAM NAMES FROM A2]

☐ Yes ☐ No

(If A3 equals "Yes" go to A4, otherwise skip to the exit "thank you" screen)

A4. Please record your primary area of specialization. Then, using the drop down list, please select the field that comes closest to describing or including your primary area of specialization.

Primary Area of Specialization: _____

a. _____(Drop down Taxonomy list – including subfields)_____

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Appendix B (continued)

A5. *Please record any additional areas of specialization you currently have. Then, using the drop down list, please select the field that comes closest to describing or including that additional area of specialization.*

IF NONE: CHECK THIS BOX: ☐ **(should not skip to C1 but continue to A6)**

a. Area of Specialization: _____

(Drop down list of Taxonomy fields and subfields

b. Area of Specialization: _____

(Drop down list of Taxonomy fields and subfields

c. Area of Specialization: _____

(Drop down list of Taxonomy fields and subfields

d. Area of Specialization: _____

(Drop down list of Taxonomy fields and subfields

e. Area of Specialization: _____

(Drop down list of Taxonomy fields and subfields

f. Area of Specialization: _____

(Drop down list of Taxonomy fields and subfields

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Appendix B (continued)

A6. In your current position at this institution, on which <u>two</u> work activities listed below do you work the most hours, on average?

	Activity Worked <u>Most</u> Hours *Mark One Only*	**ActivityWorked the <u>Second Most</u> Hours** *Mark One Only*
Research and development	☐	☐
Teaching	☐	☐
Management or Administration	☐	☐
Professional services to individuals	☐	☐
Other – Specify activity worked <u>most</u> hours:_____	☐	☐
Other – Specify activity worked <u>second most</u> hours:_____	☐	☐

B. Prior Experience

B1. What was your status <u>immediately</u> prior to your employment as a faculty member at your current institution?

Mark One Only

☐ Student
☐ Postdoc
☐ Faculty – Professor
☐ Faculty – Associate Professor
☐ Faculty – Assistant Professor
☐ Faculty – Emeritus Professor
☐ Other – Specify title:_____

B2. Please provide the name and location of your previous employer

Previous employer: _____
City:_____
State:_____Zip Code: _____
Country:_____

Ask B3 if B1 = any response except student

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Appendix B (continued)

B3. Which of the following employment sectors best describes your last employer immediately before being hired by this institution?

Mark One Only

EDUCATION
- ☐ U.S. 4-year college or university other than medical school
- ☐ U.S. medical school (including university-affiliated hospital or medical center)
- ☐ U.S. university-affiliated research institute
- ☐ U.S. community college or technical institute
- ☐ U.S. preschool, elementary, middle, secondary school or school system
- ☐ Non-U.S. educational institution

GOVERNMENT (other than education institution)
- ☐ Foreign government
- ☐ U.S. federal government
- ☐ U.S. state government
- ☐ U.S. local government

PRIVATE SECTOR (other than education institution)
- ☐ Not-for-profit institution
- ☐ U. S. based industry or business (for profit)
- ☐ Non-U. S. based industry or business (for profit)

OTHER
- ☐ Self-employed
- ☐ Other:_____

B4. Thinking about the job you held immediately before being hired by your current institution, on which two work activities listed below did you work the most hours?

	Activity Worked Most Hours *Mark One Only*	**Activity Worked the Second Most Hours** *Mark One Only*
Research and development	☐	☐
Teaching	☐	☐
Management or Administration	☐	☐
Professional services to individuals	☐	☐
Other – Specify activity worked most hours:_____	☐	☐
Other – Specify activity worked second most hours:_____	☐	☐

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Appendix B (continued)

C. Educational Background

C1. Please indicate all degrees earned beyond your bachelor's degree

Mark All That Apply

☐ Doctorate (e.g. PhD DSc EdD etc.)
☐ Other professional degree (e.g. JD LLB MD DDS DVM etc.)
☐ Master's degree (e.g. MS MA MBA MFA)
☐ Other – Specify degree:_____

C2. What institution conferred your Ph.D. or equivalent degree? If a U.S. institution, please use the dropdown list to select the school. If a foreign institution, please enter the name and address of that institution below

Drop down list
of U.S. Institutions Foreign Institution (record below)

Institution Name: _____
City: _____
Country: _____

C3. Using the drop down list, please pick the field that comes closest to the field of your Ph.D. or equivalent degree.

_____[Drop down Taxonomy list—including subfields]_____

Other field – please specify:
_____

C4. In what year was your Ph.D. or equivalent degree conferred?

Year: ☐☐☐☐

C5. Using the Association of American Universities (AAU) definition detailed below, have you ever held a postdoctoral position (postdoc)?

The AAU **definition of a postdoctoral scholar** states:

- The appointee was recently awarded a Ph.D. or equivalent doctorate (e.g., Sc.D., M.D.) in an appropriate field; and
- the appointment is temporary; and
- the appointment involves substantially full-time research or scholarship; and
- the appointment is viewed as preparatory for a full-time academic and/or research career; and
- the appointment is not part of a clinical training program; and

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Appendix B (continued)

- the appointee works under the supervision of a senior scholar or a department in a university or similar research institution (e.g., national laboratory, NIH, etc.); and
- the appointee has the freedom, and is expected, to publish the results of his or her research or scholarship during the period of the appointment.

(See: http://www.aau.edu/reports/PostDocRpt.html.)

☐ Yes ☐ No *skip to D1*

C6. How many postdoctoral appointments have you held?

Number of Postdocs Held: ☐

C7. For each postdoc held, please enter the number of years that you held the postdoc and the sector in which you were working.

- *If you have held more than 4 postdoctoral appointments, please list the four most recent*

	Number of Years	Sector (drop down list from B3)
Most Recent		
Second Most Recent		
Third Most Recent		
Fourth Most Recent		

D. Scholarly Activity

The questions in this section will help us match productivity data such as publications, citations, research grants and other types of scholarly productivity with the faculty who participate in the graduate program There will be two primary sources of data. The first will be the data provided by the journals monitored by the Institute for Scientific Information (ISI). The list can be found at: http://scientific.thomson.com/mjl/. The second will be your answers to the questions below. In counting publications, in most cases, the NRC will limit itself to books, monographs, and articles and reviews in refereed journals. It is especially important that you list books, monographs, and articles in edited volumes and in specialist journals not covered by ISI so that we have a full picture of your scholarly productivity. In addition, if there are other kinds of scholarly production that you feel give a complete picture of your scholarship, please list them below in D5

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Appendix B (continued)

D1. Under what names or variants of your name have you published books or articles in the past five years (e.g. Jane Doe, Jane H. Doe, J. H. Doe or other prior names)?

- *If you are in the Humanities, please include the names or variants of your name under which you have published books or articles in the past 10 years (1996-2006).*

_____

_____

_____

D2. Please list the Zip Codes that appeared on your publications as a reflection of your professional location between 2001 and 2006.

- *If you are in the Humanities, please list the zip codes that appeared on your publications in the past 10 years (1996-2006).*

Zip Code 1 _____

Zip Code 2 _____

Zip Code 3 _____

Zip Code 4 _____

Zip Code 5 _____

Zip Code 6 _____

Zip Code 7 _____

Zip Code 8 _____

D3. Please list the titles of books that you have authored, co-authored or edited from 2001 to 2006.

- *If you are in the Humanities, please list the titles of books you have authored, co-authored or edited in the past 10 years (1996-2006).*
- *If you have an electronic version of your CV, you may want to cut and paste the requested information*

Books Authored or Co-authored	**Books Edited**
Book 1:_____	**Book 1:**_____
Book 2:_____	**Book 2:**_____
Book 3:_____	**Book 3:**_____
Book 4:_____	**Book 4:**_____
Book 5:_____	**Book 5:**_____

[allow up to Book 30}

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Appendix B (continued)

D4. Please list any papers you authored or co-authored from 2001 to 2006.

- ***Faculty in the Arts and Humanities:*** *Since ISI coverage of publications in the Arts and Humanities is spotty, it is important that these faculty provide as complete a listing as possible of papers authored or co-authored in the* ***past 10 years (1996-2006).*** *If you would like to browse the ISI website, here is the link:* http://scientific.thomson.com/mjl/
- ***Papers listed on your CV:*** *If you upload your CV, there is no need to reenter papers already listed there. You will have an opportunity to upload your CV when you reach the end of the questionnaire*
- ***Additional papers not included on your CV****. To include papers not on your CV, you can upload a list of these papers by using this link [LINK].*
- ***For journal articles****, please remember to add the volume number.*
- ***For articles in edited volumes.*** **Please enter these in D5.**

Authors	Title	Journal	Year of Publication
_____	_____	_____	☐☐☐☐
_____	_____	_____	☐☐☐☐
_____	_____	_____	☐☐☐☐
_____	_____	_____	☐☐☐☐
_____	_____	_____	☐☐☐☐

[allow up to 30 articles]

D5. Please list any other scholarly product (e.g. shows curated, databases assembled, etc.) from the period 2001 to 2006 not covered above.

- *If you are in the Humanities, please list any other scholarly product from the past 10 years (1996-2006) not covered above.*
- ***For All Faculty,*** *If you wish to list chapters contributed to edited volumes, please list them here showing chapter title and volume title. Alternatively, we can extract them from your CV, which you should attach.*

Authors	Title	Year
_____	_____	☐☐☐☐
_____	_____	☐☐☐☐
_____	_____	☐☐☐☐
_____	_____	☐☐☐☐
_____	_____	☐☐☐☐
_____	_____	☐☐☐☐

[allow up to 30 products]

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Appendix B (continued)

D6. To what scholarly or professional societies do you belong?

- *If you have an electronic version of your CV, you may want to cut and paste the requested information.*

_____
_____
_____
_____
_____

[allow 8]

E. Research Activity

E1. Is any of your work currently supported by an extramural grant or contract?

☐ Yes ☐ No *skip to E4*

Ask E2 if E1 = yes

E2. How many extramural grants or contracts currently fund your work?

Number of Current Grants/Contracts: [___]

a. For how many of these extramural grants or contracts do you currently serve as:

	Number of Grants/Contracts *If None: Enter Zero*
1. The sole principal investigator	[ ]
2. A co-principal investigator	[ ]

E3. Currently, how many doctoral students are supported on your extramural funding (grants or contracts)?

If None: Enter Zero

Number of Supported
Doctoral Students: [__]___]

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Appendix B (continued)

E4. Since July 1, 2001, have you either: 1) submitted a disclosure to your university's licensing or tech transfer office, 2) filed for a patent or 3) were named as an inventor on a licensed patent?

☐ Yes ☐ No *skip to E5*

Ask E4a if E4 = yes

E4a. Since July 1, 2001 . . .

If none, enter zero
Enter Number

1. How many disclosures have you submitted to your university's licensing or tech transfer office? _____
2. How many patents applications have you filed? _____
3. How many patents have been granted to you as an inventor? _____
4. Of the patents that have been granted to you as an inventor since July 1, 2001 (item 3 above), how many have resulted in commercialized products or processes or have been licensed? _____

[program will check that E4a3 > 0, if E4a3 >0 then E4a4 >0 and not less than E4a3]

E5. To what extent is your current research related to the field of your Ph.D. or equivalent degree?

☐ Closely related
☐ Somewhat related
☐ Not related

Ask E6 if C5 = yes

E6. To what extent is your current research related to your postdoc experience immediately prior to becoming a faculty member?

☐ Closely related
☐ Somewhat related
☐ Not related

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Appendix B (continued)

F. Doctoral Students

F1. Please provide a list of doctoral students at your current institution for whom you served as primary dissertation adviser who have completed their studies and received their doctorate in the past five (5) years (2001-02 through 2005-06). For each doctorate holder, please indicate the year in which the degree was awarded and current position and employer, if known.

Name	Degree Year	Current Position	Current Employer	City	State	Country

[allow 40]

G. Program Quality

The charge to the Committee on an Assessment of Research-Doctorate Programs includes the design and calculation of program ratings that use collected data to quantitatively estimate program quality. The committee will construct one set of ratings based on the perceptions of graduate faculty of the relative importance of program characteristics to the quality of doctoral programs. This section of the questionnaire asks you to describe the relative importance of program characteristics as determinants or indicators of program quality.

Specific Characteristics: Program Faculty Quality (Category I)

G1. In Column A, please select the characteristics in this category (up to FOUR) that you feel are the most important to program quality. In Column B, if you selected more than two characteristics, please select the TWO you feel are the most important.

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Appendix B (continued)

CATEGORY I -- Program Faculty Quality	**Column A** **Most Important Characteristics** (*Mark Up to Four)*	**Column B** **Two Most important Characteristics**
a. Number of publications (books, articles, etc.) per faculty member	☐	☐
b. Number of citations per faculty member	☐	☐
c. Receipt of extramural grants for research	☐	☐
d. Involvement in interdisciplinary work	☐	☐
e. Racial/ethnic diversity of the program faculty	☐	☐
f. Gender diversity of the program faculty	☐	☐
g. Reception by peers of a faculty member's work as measured by honors and awards	☐	☐

Specific Characteristics: Student Characteristics (Category II)

G2. In Column A, please select the characteristics in this category (up to FOUR) that you feel are the most important to program quality. In Column B, if you selected more than two characteristics, please select the TWO you feel are the most important.

CATEGORY II -- Student Characteristics	**Column A** **Most Important Characteristics** (*Mark Up to Four)*	**Column B** **Two Most important Characteristics**
a. Median GRE scores of entering students	☐	☐
b. Percentage of students receiving full financial support	☐	☐
c. Percentage of students with portable fellowships	☐	☐
d. Number of student publications and presentations	☐	☐
e. Racial/ethnic diversity of the student population	☐	☐
f. Gender diversity of the student population	☐	☐
g. A high percentage of international students	☐	☐

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Appendix B (continued)

Specific Characteristics: Program Characteristics (Category III)

G3. In Column A, please select the characteristics in this category (up to FOUR) that you feel are the most important to program quality. In Column B, if you selected more than two characteristics, please select the TWO you feel are the most important.

CATEGORY III -- Program Characteristics	**Column A** **Most Important Characteristics** (*Mark Up to Four)*	**Column B** **Two Most important Characteristics**
a. Average number of Ph.D.s granted over the last five years	☐	☐
b. Percentage of entering students who complete a doctoral degree	☐	☐
c. Time to degree	☐	☐
d. Placement of students after graduation	☐	☐
e. Percentage of students with individual work space	☐	☐
f. Percentage of health insurance premiums covered by the institution or program	☐	☐
g. Number of student support activities provided at either the institutional or program level (This variable will be a tally of whether the following services are provided to graduate students at either the institutional or program level: orientation for new students, prizes/awards to doctoral students for teaching and/or research, formal training in academic integrity/ethics, travel funds to attend professional meetings, grievance/dispute resolution procedures, annual review of all enrolled doctoral students, training to improve teaching skills, institutionally-supported graduate student association, information about employment outcomes of graduates and on-campus graduate student research conferences).	☐	☐

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Appendix B (continued)

General Characteristics

G4. Please assign a score to each category with the total adding up to 100, where 0 indicates the category has no importance to your judgment of quality and 100 indicates it is the only category that is important.

Category	**Score**
Category 1: Program Faculty Quality Characteristics	
Category 2: Student Characteristics	
Category 3: Program Characteristics	
Total	**100**

H. Demographic Information

H1. In what year were you born?

Year of birth: ☐☐☐☐

H2. Are you:

☐ Male ☐ Female

H3. What is your citizenship status?

☐ U.S.
☐ Permanent Resident
☐ Temporary Visa Holder

H4. Are you Hispanic (or Latino).

☐ Yes ☐ No *skip to H6*

H5. Which of the following best describes your Hispanic origin or descent?

Mark one only

☐ Mexican or Chicano
☐ Puerto Rican
☐ Cuban
☐ Other Hispanic descent – specify_____

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Appendix B (continued)

H6. What is your racial background

Mark all that apply

- ☐ American Indian or Alaska Native
- ☐ Native Hawaiian or other Pacific Islander
- ☐ Asian
- ☐ Black or African-American
- ☐ White

I1. To help us understand the characteristics of faculty in doctoral programs without asking additional questions, and to enable us to access data from national databases (e.g., on citation counts), please attach your current C.V. when you submit this questionnaire.

☐ C. V. attached

J1. Would you be willing to answer an additional questionnaire that would ask you to rate the overall quality of other doctoral programs in your field?

- ☐ Yes
- ☐ No

Ask J2 if J1 = yes

J2. Good contact information is needed for those selected. Please fill in your preferred contact information below.

ADDRESS: _____

_____

_____

_____

CITY: _____ STATE: _____ ZIP CODE: _____

J3. Please provide your preferred e-mail address where you can be reached if there are responses in your questionnaire that require clarification or if you prefer to be contacted about the program ratings by email.

Email address: _____

Thank you for your time.

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APPENDIX C

Admitted-to-Candidacy Student Questionnaire

Welcome to the National Research Council's

2006 Assessment of Research Doctorate Programs
Admitted-to-Candidacy Doctoral Student Questionnaire

This questionnaire is part of the National Research Council's **2006 Assessment of Research Doctoral Programs**. The National Research Council (NRC) is the operating arm of the National Academy of Sciences, an institution that conducts studies on issues relevant to questions of importance to educational, scientific and technological policy. Its reports are highly respected and have important impact on national and institutional policymakers.

This is the first NRC assessment of doctoral programs in over ten years. The study is an effort to gather data about doctoral programs nationwide and provide data that will be helpful to students, faculty, administrators and those who make educational policy.

For the first time, the assessment is including a survey of doctoral students. By completing this questionnaire, you provide information that will: (1) bring a student perspective to the study; (2) permit a statistical description of the advanced doctoral students in your field, and (3) help the NRC identify the multiple dimensions of successful graduate programs.

Further information about the assessment may be found at www7.nationalacademies.org/resdoc/index.html. This site also has a list of Frequently Asked Questions and contains an Email link for submitting questions you might have about the study or the questionnaire.

As a graduate student, this is an important opportunity for you to be heard on issues related to graduate education, both in your program and in general. If you and your fellow students respond at a high rate, the results will provide important information about and to your program that will help facilitate change in graduate education at the program level.

Your responses to this online questionnaire will be entered directly into our database and treated as completely confidential by the NRC. Your individual answers will not be shared with faculty or administrators of your doctoral program. Any data, including race/ethnicity and gender, that is not currently available to the public will only be used in aggregated form that cannot be used to discern the identity of any survey participant in any report or presentation concerning the survey or in the public use file that will be made available to the public at the conclusion of this study. The link between your name and the data you provide will be removed prior to the publication of the public use file. In the case of

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questions with an open-ended response, comments will be reported only in an anonymous form that does not disclose the identity of the respondent.

Your participation is voluntary. You may refuse to answer any question or discontinue participation at any point. There is no personal risk to you in responding to this questionnaire since your identify will be known only to the National Research Council and Mathematica Policy Research. No information concerning respondents will be given to your institution. If you have any questions related to the study or this questionnaire, please send an email to **NRC-Assessment@mathematica-mpr.com**

Please click here to indicate your informed consent to participate in this study ☐

Part A. Education

The questions in this section are designed to collect information on your education and how you have been financially supported during your doctoral program.

A1. When did you first enroll in this doctoral program?

Month ☐☐ Year ☐☐☐☐

A2. When were you admitted to candidacy for the doctorate?

Month ☐☐ Year ☐☐☐☐

A2a. Please record your primary area of specialization. Then, using the drop down list, please select the field that comes closest to describing or including your primary area of specialization.

Primary Area
of Specialization: _____

(Drop down Taxonomy list – including subfields)_____

A2b. Please record any additional areas of specialization you currently have. Then, using the drop down list, please select the field that comes closest to describing or including that additional area of specialization.

IF NONE: MARK THIS BOX: ☐

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1. **Area of Specialization:** _____

(Drop down list of Taxonomy fields and subfields

2. **Area of Specialization:** _____

(Drop down list of Taxonomy fields and subfields

3. **Area of Specialization:** _____

(Drop down list of Taxonomy fields and subfields

A3. When do you expect to be awarded your doctorate?

Month ☐☐ Year ☐☐☐☐

A4. Before entering this doctorate program, had you already completed a master's degree in:

	Mark Yes or No for Each	
	Yes	**No**
a. Your current field?	☐	☐
b. Another field - specify: _____	☐	☐

A5. While studying for your doctorate, will you also receive any of the following as part of a joint, concurrent, or combined degree program:

	Mark Yes or No for Each	
	Yes	**No**
a. Professional doctorate (e.g., MD, DDS, OD, JD)?	☐	☐
b. Professional master's degree (e.g., MBA, MPA, MPH, PSM)?	☐	☐
c. Master's degree in your current doctoral program?	☐	☐
d. Master's degree in a different field?	☐	☐

Ask A6 if any "yes" responses to A4 or A5c or A5d

A6. Did you write a master's thesis?

☐ Yes
☐ No

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Appendix C (continued)

A7. While studying for the doctorate, will you receive a <u>certificate</u> in another field or skill area?

☐ Yes
☐ No

A8. While in your program, how many <u>research presentations</u> (including poster presentations) have you made at:

	Number If None: Enter Zero
a. Research conferences on your campus (including other units of a multi-campus system)?	☐☐
b. At regional, national, or international meetings?.....	☐☐

A9. Have you received <u>travel funds</u> for research presentations at regional, national, or international meetings?

☐ Yes
☐ No *(skip to A11)*

Ask A10 if A9 = yes

A10. From which of the following sources have you received travel funds for research presentations?

IF NOT KNOWN: MARK THIS BOX: ☐

Mark up to three

☐ National Fellowship
☐ Traineeship
☐ Professional Society
☐ Graduate program
☐ University or school/college
☐ Extramural grant
☐ Other – Specify source:

_____

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Appendix C (continued)

A11. How many research publications have you <u>authored or coauthored</u> before and during your doctoral studies (include pieces accepted for publication but not yet published)?

	Before Doctoral Studies	During Doctoral Studies
a. Refereed articles	☐☐	☐☐
b. Book chapters	☐☐	☐☐
c. Book reviews	☐☐	☐☐
d. Books or edited volumes	☐☐	☐☐
If None: Mark Here	☐	☐

A12. Which of the following have been your <u>largest</u> sources of financial support during your doctoral program?

Mark up to three sources

☐ ***National Fellowship/Scholarship***
☐ ***Institutional Fellowship/Stipend***
☐ ***Traineeship***
☐ ***Teaching assistantship (TA)***
☐ ***Research assistantship (RA)***
☐ ***Other assistantship (e.g., general assistantship)***
☐ ***Internship, clinical residency***
☐ ***Personal earnings during graduate school (other than sources listed above)***
☐ ***Loans (from any source)***
☐ ***Personal savings***
☐ ***Spouse's, partner's, or family earnings or savings***
☐ ***Employer's reimbursement/assistance***
☐ ***Foreign (non-U.S.)***
☐ ***Other – Specify source:_____***

Ask A13 if any of the first 7 categories in A12 are checked

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Appendix C (continued)

A13. If you had a fellowship, scholarship, traineeship, or assistantship, with what degree of support did it provide you?

Mark one only

☐ Full
☐ Partial

Part B: Postgraduation Plans

The questions in this section are designed to collect information on your career plans and whether and how they have changed over time.

B1. When you entered your doctoral program, what were your primary and secondary career goals?

Mark One in Each Column

	Primary	**Secondary**
a. Research and development	☐	☐
b. Teaching	☐	☐
c. Management or administration	☐	☐
d. Professional services to individuals	☐	☐
e. Other – Specify goal:	☐	☐
_____		
If No Secondary Career Goals: Mark this Box		☐

B2. <u>At this time</u>, what are your primary and secondary career goals?

Mark One in Each Column

	Primary	**Secondary**
a. Research and development	☐	☐
b. Teaching	☐	☐
c. Management or administration	☐	☐
d. Professional services to individuals	☐	☐
e. Other - specify:	☐	☐
_____		
If No Secondary Career Goal: Mark this Box		☐

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Appendix C (continued)

B3. Do you feel supported by your advisor in your current career goals?

- ☐ Yes
- ☐ No
- ☐ Not Certain

B4. When you entered your doctoral program, for what type of employer did you believe you would work when you graduated?

Mark one only

EDUCATION

- ☐ U.S. 4-year college or university other than medical school
- ☐ U.S. medical school (including university-affiliated hospital or medical center)
- ☐ U.S. university-affiliated research institute
- ☐ U.S. community college or technical institute
- ☐ U.S. preschool, elementary, middle, secondary school or school system
- ☐ Non-U.S. educational institution

GOVERNMENT (other than education institution)

- ☐ Foreign government
- ☐ U.S. federal government
- ☐ U.S. state government
- ☐ U.S. local government

PRIVATE SECTOR (other than education institution)

- ☐ Not-for-profit institution
- ☐ U. S. based industry or business (for profit)
- ☐ Non-U.S. based industry or business (for profit)

OTHER

- ☐ Self-employed
- ☐ Other – Specify sector:

_____

B5. <u>At this time</u>, for what type of employer do you expect to work when you graduate?

Mark one only

EDUCATION

- ☐ U.S. 4-year college or university other than medical school
- ☐ U.S. medical school (including university-affiliated hospital or medical center)
- ☐ U.S. university-affiliated research institute
- ☐ U.S. community college or technical institute
- ☐ U.S. preschool, elementary, middle, secondary school or school system
- ☐ Non-U.S. educational institution

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Appendix C (continued)

GOVERNMENT (other than education institution)

☐ Foreign government
☐ U.S. federal government
☐ U.S. state government
☐ U.S. local government

PRIVATE SECTOR (other than education institution)

☐ Not-for-profit institution
☐ Industry or business (for profit)
☐ Non-U.S. based industry or business (for profit)

OTHER

☐ Self-employed
☐ Other – Specify sector:

_____

Part C: Program Characteristics

We are interested in the characteristics of your program and your perception of the program's quality.

C1. Did your institution or graduate program provide you with an <u>orientation</u> when you matriculated?

☐ Yes
☐ No

C2. When you entered your doctoral program, did the program provide you with <u>written</u> expectations (e.g., a handbook) about academic progress?

☐ Yes
☐ No

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Appendix C (continued)

C3. During your doctoral program, have you or will you participate in formal *(e.g., school- or program-sponsored class or seminar)* or informal *(e.g., individual conversations with mentor)* instruction, practice or professional development training in:

Mark one for each activity

	Formal Only	Informal Only	Both Formal and Informal	Neither
a. Oral communication and presentation skills?	☐	☐	☐	☐
b. Speaking to nonacademic audiences?	☐	☐	☐	☐
c. Writing proposals for funding?	☐	☐	☐	☐
d. Preparing articles for publication?	☐	☐	☐	☐
e. Working in collaborative groups?	☐	☐	☐	☐
f. Conducting independent research/scholarship?	☐	☐	☐	☐
g. Project management?	☐	☐	☐	☐
h. Research/professional ethics?	☐	☐	☐	☐
i. Teaching/pedagogy?	☐	☐	☐	☐
j. Supervision and evaluation?	☐	☐	☐	☐
k. Preparation for job interviews?	☐	☐	☐	☐

C4. During your doctoral program have you, or do you, expect to:

Mark Yes or No for each

	Yes	No
a. Mentor or tutor a high school student?	☐	☐
b. Mentor or tutor an undergraduate student?	☐	☐
c. Mentor or tutor a graduate student?	☐	☐
d. Grade papers for undergraduate or graduate courses?	☐	☐
e. Lead discussion sections of undergraduate or graduate courses?	☐	☐
f. Lead laboratory sections of undergraduate or graduate courses?	☐	☐
g. Guest lecture in undergraduate or graduate courses?	☐	☐
h. Teach a course based on a previously set curriculum?	☐	☐
i. Teach a course based on a curriculum you developed?	☐	☐

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Appendix C (continued)

C5. Other than course grades, does your program provide <u>an annual or more frequent assessment</u> of your academic progress? (examples: a letter from the program, a meeting with your dissertation committee)

☐ Yes
☐ No *(skip to C7)*

Ask C6 if C5 = Yes

C6. Are these assessments helpful?

☐ Yes
☐ No

C7. Have you begun your doctoral dissertation research?

☐ Yes
☐ No *(skip to C10)*

Ask C8 if C7 = Yes

C8. Have you received <u>timely</u> feedback on this research?

☐ Yes
☐ No *(skip to C10)*

Ask C9 if C8 = Yes

C9. Has this feedback been helpful?

☐ Yes
☐ No

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Appendix C (continued)

C10. Are there one or more faculty members at your institution whom you consider as mentors, either in your program or external to it?

- **A** mentor **is an individual from whom you seek advice about your education, career development or other matters of concern to you as a graduate student**

	Mark Yes or No for each	
	Yes	**No**
a. I have a mentor in my program.....	☐	☐
b. I have a mentor external to my program.....	☐	☐

C11. Do you have access to career advice?

☐ Yes
☐ No *(skip to C16)*

Ask C12 if C11 = Yes

C12. Have you taken advantage of the opportunity for career advice?

☐ Yes
☐ No *(skip to C16)*

Ask C13 and C14 if C12 = Yes

C13. Who has provided the advice?

Mark all that apply

☐ An individual who serves as both advisor and mentor
☐ Advisor
☐ Mentor
☐ Graduate program director/coordinator
☐ Program staff
☐ University-wide career office
☐ Other – Specify who advised you:

_____

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Appendix C (continued)

C14. Does the advice cover a variety of employment sectors (e.g., employment outside of academic institutions)?

☐ Yes
☐ No
☐ Don't Know

C15. Which source of career advice did you find <u>most</u> helpful?

Mark one only

☐ An individual who serves as both advisor and mentor
☐ Advisor
☐ Mentor
☐ Graduate program director/coordinator
☐ Program staff
☐ University-wide career office
☐ Other – Specify most helpful source:

_____

C16. On a scale of 1 to 5 where 1 is distant and 5 is interactive, how would you characterize your overall relationship with:

Mark one for each category

	Highly Interactive, Supportive		**Neutral**		**Distant, Antagonistic or Hostile**
	5	**4**	**3**	**2**	**1**
a. your faculty advisor?	☐	☐	☐	☐	☐
b. the faculty in your program?.....	☐	☐	☐	☐	☐

C17. On a scale of 1 to 5, how supportive are students in your program of one another?

Mark one only

☐ 5 Very supportive
☐ 4
☐ 3 Somewhat supportive
☐ 2
☐ 1 Not supportive

C18. Does your program encourage students to interact with faculty outside of your program?

☐ Yes ☐ No

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Appendix C (continued)

C19. Thinking about your doctoral program, how satisfied are you with the quality of the:

Mark one for each category

	Very Satisfied	Somewhat Satisfied	Not Satisfied
a. Teaching by the faculty?	☐	☐	☐
b. The dissertation supervision?	☐	☐	☐
c. Your research experience in the program?	☐	☐	☐
d. Your program's curriculum?	☐	☐	☐
e. The overall quality of the program?	☐	☐	☐

C20. How much do you feel you have benefited from the:

Mark one for each category

	A Lot	Some	Not At All
a. Intellectual environment of your program?	☐	☐	☐
b. Intellectual environment of your institution?	☐	☐	☐

C21. How satisfied are you with the quality of program-sponsored activities designed to promote social interaction of students with faculty and with other students?

☐ Very satisfied
☐ Somewhat satisfied
☐ Not satisfied

C22. How much do you feel you belong to your program?

☐ A lot
☐ Some
☐ Not at all

C23. In the space below, please provide any additional comments you would like to make about your doctoral program, its characteristics or quality:

_____

_____

Part D: Resources

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Appendix C (continued)

We are interested in your perception of the adequacy of the resources available to you for your graduate work and dissertation research.

D1. Thinking about your graduate education and dissertation research, please rate the adequacy of the support that has been available to you in each of the following areas:

Mark one for each category

	Excellent	Good	Fair	Poor	Not Applicable	Don't Know
a. Computer resources?	☐	☐	☐	☐	☐	☐
b. Other research, laboratory, clinical or studio facilities?	☐	☐	☐	☐	☐	☐
c. Library resources?	☐	☐	☐	☐	☐	☐
d. Your on campus personal work space?	☐	☐	☐	☐	☐	☐
e. Space available for social interaction among students in your program (e.g., coffee nook, lunch room)?	☐	☐	☐	☐	☐	☐
f. University-provided housing or housing support?	☐	☐	☐	☐	☐	☐
g. University-provided child care facilities or child care support?	☐	☐	☐	☐	☐	☐
h. University recreational/athletic facilities?	☐	☐	☐	☐	☐	☐
i. Healthcare and/or health services provided by your program or university?	☐	☐	☐	☐	☐	☐

D2. In the space below, please provide any additional comments you would like to make about program or university resources available to you:

_____

_____

_____

Part E: Background Information

E1. Are you:

☐ Male
☐ Female

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Appendix C (continued)

E2. What is your marital status?

Mark one only

- ☐ Married
- ☐ Living in a marriage-like relationship
- ☐ Widowed
- ☐ Divorced
- ☐ Separated
- ☐ Never married

E3. Not including yourself or your spouse/partner, how many <u>dependents</u> do you have—that is, how many others receive at least one half of their <u>financial</u> support from you?

If No Dependents: Mark this box: ☐

		Number
a.	5 years of age or younger.....	☐☐
b.	6 to 18 years.....	☐☐
c.	19 years or older	☐☐

E4. Including children, elderly parents or others, as appropriate, for how many people are you a primary caregiver?

Number: ☐☐

E5. What is the highest educational attainment of your mother and father (or guardian)?

		Mark one for each	
		Mother	**Father**
a.	Less than high/secondary school graduation	☐	☐
b.	High/secondary school graduate.....	☐	☐
c.	Some college.....	☐	☐
d.	Bachelor's degree	☐	☐
e.	Master's degree (e.g., MA, MS, MBS, MSW, etc.).....	☐	☐
f.	Professional degree (e.g., JD, LLB, D.Min, MD, DDS, etc.)	☐	☐
g.	Doctoral degree.....	☐	☐
h.	Not applicable.....	☐	☐

E6. In what year were you born?

Year of Birth: ☐☐☐☐

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Appendix C (continued)

E7. What is your citizenship status?

Mark one only

U.S. Citizen
☐ Since birth
☐ Naturalized

Non-U.S. Citizen
☐ With a Permanent U.S. Resident Visa ("Green Card")
☐ With a Temporary U.S. Visa

E8. Are you Hispanic (or Latino)?

☐ Yes
☐ No *(skip to E10)*

E9. Which of the following best describes your Hispanic origin or descent?

Mark one only

☐ Mexican or Chicano
☐ Puerto Rican
☐ Cuban
☐ Other Hispanic – Specify Hispanic descent:
_____

E10. What is your racial background?

Mark all that apply

☐ American Indian or Alaska Native
☐ Native Hawaiian or other Pacific Islander
☐ Asian
☐ Black or African-American
☐ White

Thank you for your time!

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APPENDIX D

Descriptive Statistics for *Neuroscience*

	Mean	Standard Deviation (SD)	Lowest score	Highest score
Satisfaction	1.5390	.22337	2.00[40]	1.10
Belonging	1.5471	.20978	2.18[41]	1.23
%wMentor	.9289	.07310	75%	100%
%Married	.3370	.12352	8%	62%
%wKids	.1446	.08881	0%	36%
%FacGrants	90.5220	8.52566	70%	100%
%Financed	98.5266	5.95510	67%	100%
%MinFac	3.1211	3.86795	0%	19.23%
%FemFac	24.5493	8.58659	0%	50%
GRE	715.3407	42.08109	612	800
#Activities	16.6552	1.76269	11	18
1st year size	9.2575	4.57864	1.8	22.4
%FemStud	51.2266	10.92466	24.4%	76.5%
TTD	5.8408	.56803	4.56 years	7.26 years
%MinStud	11.6500	8.09279	0%	40%

[40] Lower scores on the Satisfaction rating scale indicated higher ratings (1=Very Satisfied, 2=Somewhat Satisfied, 3=Not Satisfied) so lower scores should be interpreted positively.
[41] Lower scores on the Sense-of-Belonging scale indicated higher sense of belonging (1= A lot, 2=Some, 3=Not at all) so lower scores should be interpreted positively.

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Appendix D (continued)

	Mean	Standard Deviation (SD)	Lowest score	Highest score
#Faculty	44.0172	25.97063	6	143
#Enrolled	50.7069	27.36499	15	122
%RA	.2931	.26651	0	81%
%TA	.0346	.10334	0%	47%
Ratio	.9499	.45162	.11	2.87
Orientation	.8276	.56624	0	100%
AnRev	.8966	.44681	0	100%

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APPENDIX E

Descriptive Statistics for *Chemical Engineering*

	Mean	Standard Deviation (SD)	Lowest score	Highest score
Satisfaction	1.5390	.21755	2.27[42]	1.15
Belonging	1.4511	.16676	1.81[43]	1.11
%wMentor	.8074	.13619	5%	100%
%Married	.4017	.16819	0%	77%
%wKids	.1821	.11158	0%	46%
%FacGrants	86.3646	12.50628	43%	100%
%Financed	97.6859	8.67606	50%	100%
%MinFac	5.6071	5.69023	0%	18.18%
%FemFac	11.9491	7.03467	0%	28.57%
GRE	769.3201	22.83573	662	800
#Activities	16.2909	1.80198	10	18
1st year size	13.3491	7.56035	2	39

[42] Lower scores on the Satisfaction rating scale indicated higher ratings (1=Very Satisfied, 2=Somewhat Satisfied, 3=Not Satisfied) so lower scores should be interpreted positively.
[43] Lower scores on the Sense-of-Belonging scale indicated higher sense of belonging (1= A lot, 2=Some, 3=Not at all) so lower scores should be interpreted positively.

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Appendix E (continued)

	Mean	Standard Deviation (SD)	Lowest score	Highest score
%FemStud	29.5729	8.24955	16.67%	47.62%
TTD	5.0146	.72950	3.0 years	7.0 years
%MinStud	10.4057	9.67033	0%	50%
#Faculty	17.6727	8.10362	8	55
#Enrolled	62.0909	38.48726	15	209
%RA	.4743	.26223	0	100%
%TA	.0954	.17683	0%	100%
Ratio	.3466	.17484	.15	1.15
Orientation	.8909	.45837	0	100%
AnRev	.3818	.93276	0	100%

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APPENDIX F

Descriptive Statistics for *Physics*

	Mean	Standard Deviation (SD)	Lowest score	Highest score
Satisfaction	1.6210	.20361	2.08[44]	1.21
Belonging	1.5461	.18430	2.0[45]	1.0
%wMentor	.8377	.08921	60%	100%
%Married	.4249	.15088	12%	94%
%wKids	.1834	.13881	0%	80%
%FacGrants	83.0313	9.96384	45.16%	100%
%Financed	96.6919	7.40749	60%	100%
%MinFac	3.6163	5.25004	0%	33.33%
%FemFac	9.2658	8.28116	0%	75%
GRE	766.3697	26.58404	663	800
#Activities	16.0000	2.08409	10	18
1st year size	17.3177	9.31387	3.6	50.6
%FemStud	19.5328	6.30913	3.57%	34.85%
TTD	5.9544	.87432	3.0 years	10.0 years

[44] Lower scores on the Satisfaction rating scale indicated higher ratings (1=Very Satisfied, 2=Somewhat Satisfied, 3=Not Satisfied) so lower scores should be interpreted positively.
[45] Lower scores on the Sense-of-Belonging scale indicated higher sense of belonging (1= A lot, 2=Some, 3=Not at all) so lower scores should be interpreted positively.

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APPENDIX F (continued)

	Mean	Standard Deviation (SD)	Lowest score	Highest score
%MinStud	6.9349	7.06944	0%	40%
#Faculty	36.1287	18.65833	3	93
#Enrolled	88.2574	53.13486	16	291
%RA	.3697	.20945	0	89%
%TA	.3325	.21450	0%	85%
Ratio	.4563	.20137	.08	1.93
Orientation	.7600	.65320	0	100%
AnRev	.7800	.62893	0	100%

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APPENDIX G

Descriptive Statistics for *Economics*

	Mean	Standard Deviation (SD)	Lowest score	Highest score
Satisfaction	1.6598	.25855	2.30[46]	1.19
Belonging	1.6043	.19815	2.33[47]	1.18
%wMentor	.8218	.10284	58%	100%
%Married	.4520	.16838	0%	100%
%wKids	.1977	.11992	0%	48%
%FacGrants	40.8021	17.68636	0%	81.48%
%Financed	75.3358	26.13595	0%	100%
%MinFac	4.8228	5.31086	0%	25%
%FemFac	16.0057	10.21606	0%	66.67%
GRE	772.6621	29.51627	687	800
#Activities	16.2500	2.27478	4	18
1st year size	17.4630	8.44336	2.8	37.40
%FemStud	34.6901	10.65519	0%	76.92%

[46] Lower scores on the Satisfaction rating scale indicated higher ratings (1=Very Satisfied, 2=Somewhat Satisfied, 3=Not Satisfied) so lower scores should be interpreted positively.
[47] Lower scores on the Sense-of-Belonging scale indicated higher sense of belonging (1= A lot, 2=Some, 3=Not at all) so lower scores should be interpreted positively.

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APPENDIX G (continued)

	Mean	Standard Deviation (SD)	Lowest score	Highest score
TTD	5.6282	.71299	4.0 years	8.0 years
%MinStud	8.7579	7.27300	0%	28.57%
#Faculty	29.3281	11.64291	12	53
#Enrolled	76.7656	41.79456	9	182
%RA	.0919	.12526	0	54%
%TA	.3441	.24538	0%	100%
Ratio	.5047	.38906	.17	2.53
Orientation	.8750	.48795	0	100%
AnRev	.6563	.76051	0	100%

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APPENDIX H

Descriptive Statistics for *English*

	Mean	Standard Deviation (SD)	Lowest score	Highest score
Satisfaction	1.5731	.22618	2.67[48]	1.13
Belonging	1.7175	.21241	2.79[49]	1.22
%wMentor	.9010	.06602	69%	100%
%Married	.4730	.14410	15%	82%
%wKids	.2551	.14557	4%	67%
%FacGrants	9.2540	7.17663	0%	27.59%
%Financed	85.7997	25.66285	0%	100%
%MinFac	9.1991	4.57224	0%	21.21%
%FemFac	46.0013	7.96667	23.81%	69.44%
GRE	647.1168	44.19236	547	748
#Activities	16.2273	1.58823	10	18
1st year size	13.0508	6.50054	2.4	40.8
%FemStud	61.0195	7.60786	39.39%	75.86%

[48] Lower scores on the Satisfaction rating scale indicated higher ratings (1=Very Satisfied, 2=Somewhat Satisfied, 3=Not Satisfied) so lower scores should be interpreted positively.
[49] Lower scores on the Sense-of-Belonging scale indicated higher sense of belonging (1= A lot, 2=Some, 3=Not at all) so lower scores should be interpreted positively.

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APPENDIX H (continued)

	Mean	Standard Deviation (SD)	Lowest score	Highest score
TTD	6.9867	1.22164	4.8 years	10.42 years
%MinStud	10.2431	5.94349	0%	24.44%
#Faculty	37.9545	13.09462	15	76
#Enrolled	79.3409	37.17770	13	175
%RA	.0149	.04582	0	30%
%TA	.4655	.28930	0%	100%
Ratio	.5390	.22126	.21	1.27
Orientation	.9091	.41899	0	100%
AnRev	.5909	.81136	0	100%

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APPENDIX I

Descriptive Statistics for *All the Programs* in the Dataset

	Mean	Standard Deviation (SD)	Lowest score	Highest score
Satisfaction	1.590858	.2278234	2.67[50]	1.09
Belonging	1.583465	.2133021	2.79[51]	1.0
%wMentor	.860106	.1029511	5.4%	100%
%Married	.423793	.1569976	0%	100%
%wKids	.196849	.1311982	0%	80%
%FacGrants	59.532%	34.8479%	0%	100%
%Financed	90.763%	19.5342%	0%	100%
%MinFac	5.395%	5.4568%	0%	33%
%FemFac	22.137%	16.6489%	0%	75%
GRE	731.05750	61.443954	547	800
#Activities	16.25	1.921	4	18
1st year size	14.436	8.1610	2	51
%FemStud	38.742%	18.2995%	0%	76.9%
TTD	5.986	1.0922	3.0 years	10.4 years

[50] Lower scores on the Satisfaction rating scale indicated higher ratings (1=Very Satisfied, 2=Somewhat Satisfied, 3=Not Satisfied) so lower scores should be interpreted positively.
[51] Lower scores on the Sense-of-Belonging scale indicated higher sense of belonging (1= A lot, 2=Some, 3=Not at all) so lower scores should be interpreted positively.

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APPENDIX I (continued)

	Mean	Standard Deviation (SD)	Lowest score	Highest score
%MinStud	9.324%	7.6281%	0%	50%
#Faculty	33.86	18.429	3	143
#Enrolled	74.22	43.733	9	291
%RA	.239025	.2567985	0%	100%
%TA	.283536	.2716276	0%	100%
Ratio	.5466	.34631	.08	2.87
Orientation	.8466	.53300	0%	100%
AnRev	.6712	.74226	0%	100%

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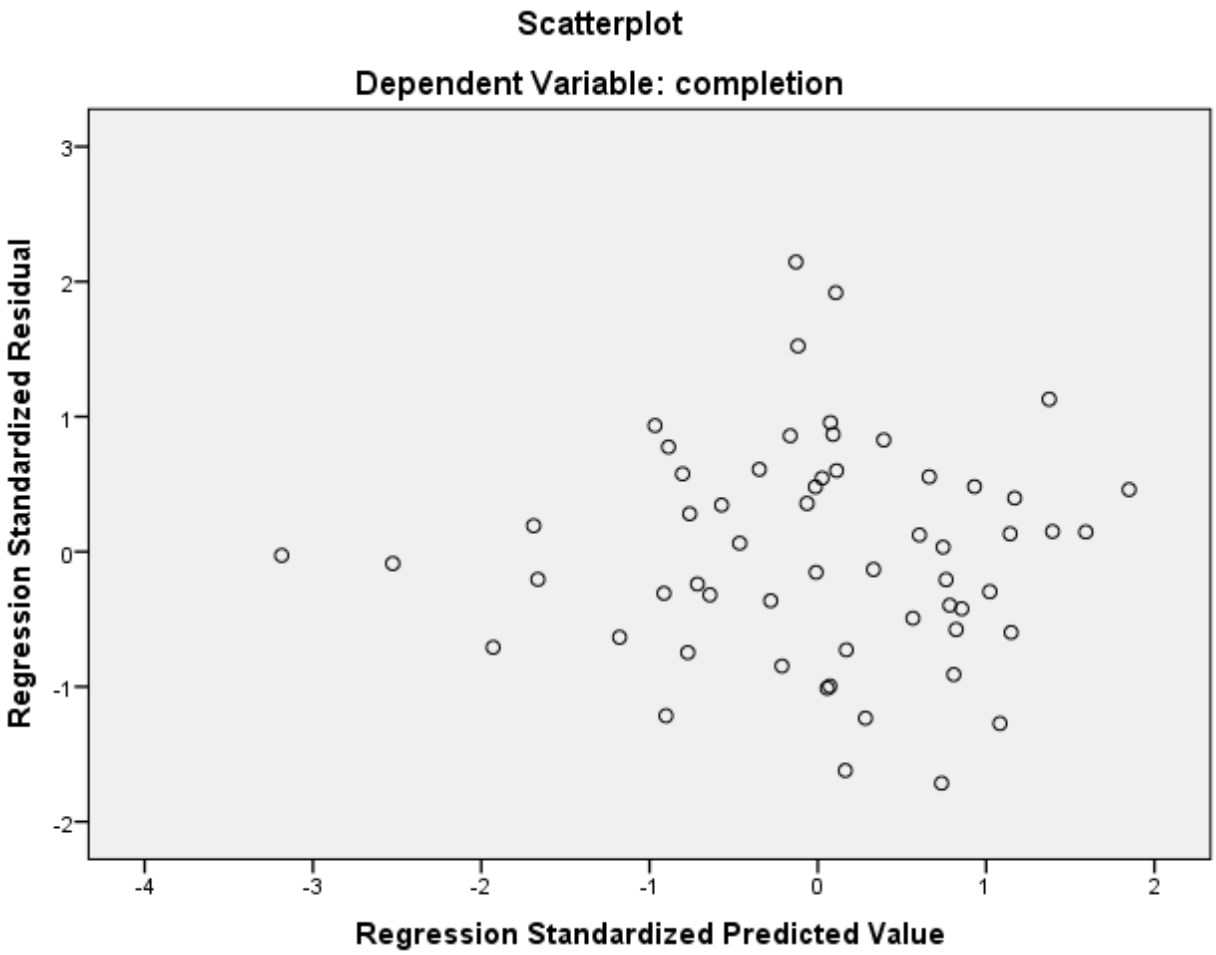
APPENDIX J

Scatterplot of the Standardized Residuals versus the Standardized Predicted Values in *Neuroscience*



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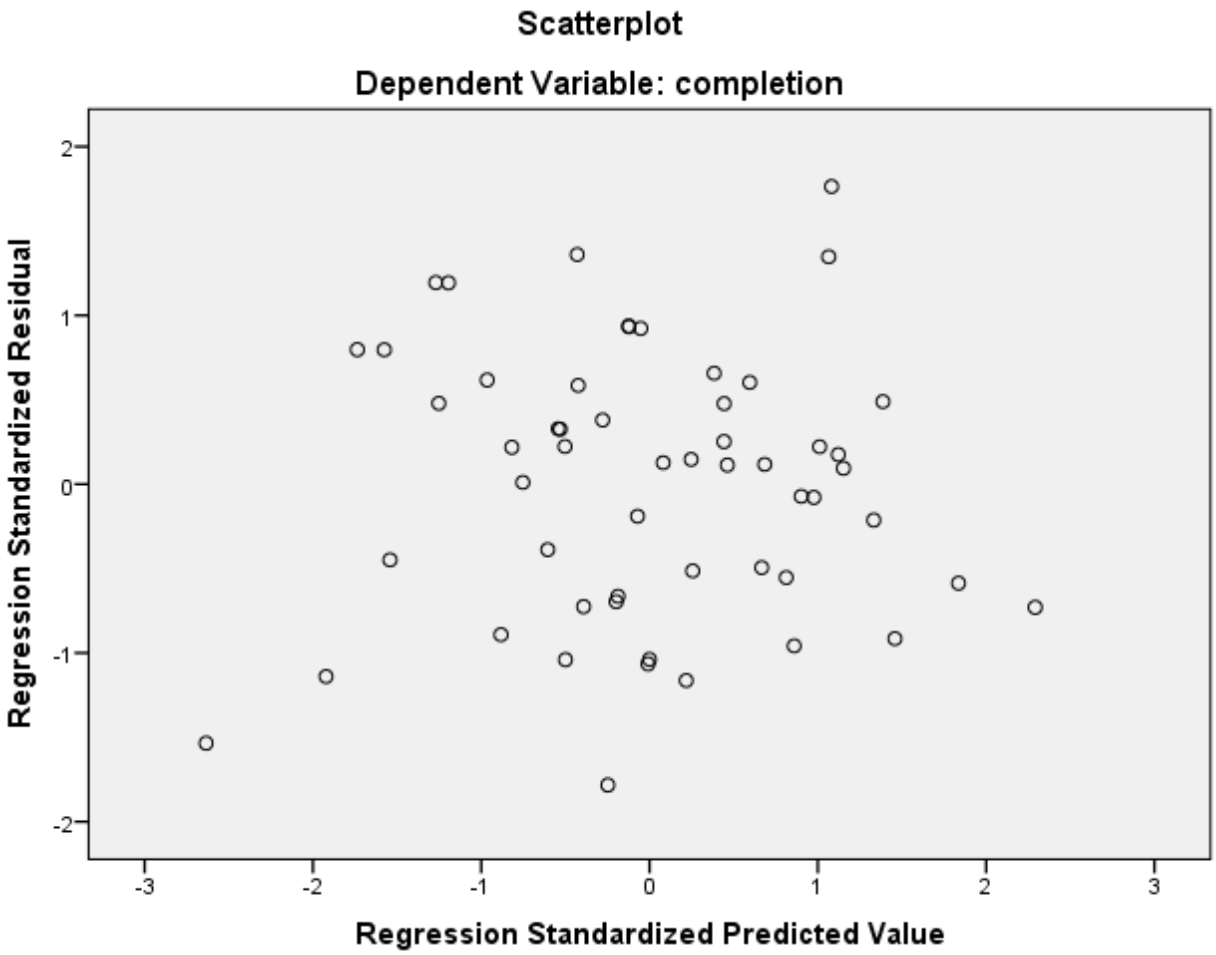
APPENDIX K

Scatterplot of the Standardized Residuals versus the Standardized Predicted Values in *Chemical Engineering*



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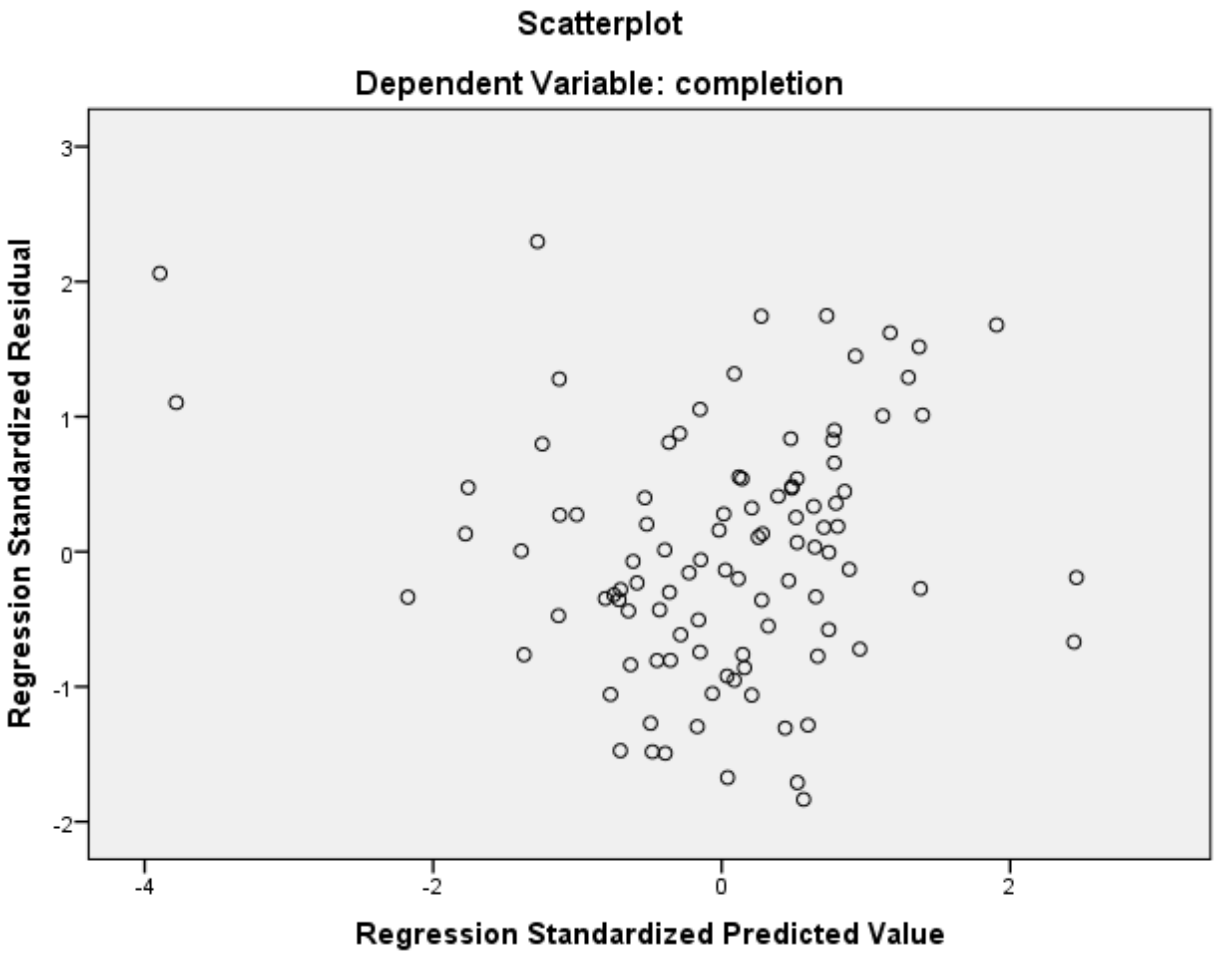
APPENDIX L

Scatterplot of the Standardized Residuals versus the Standardized Predicted Values in *Physics*



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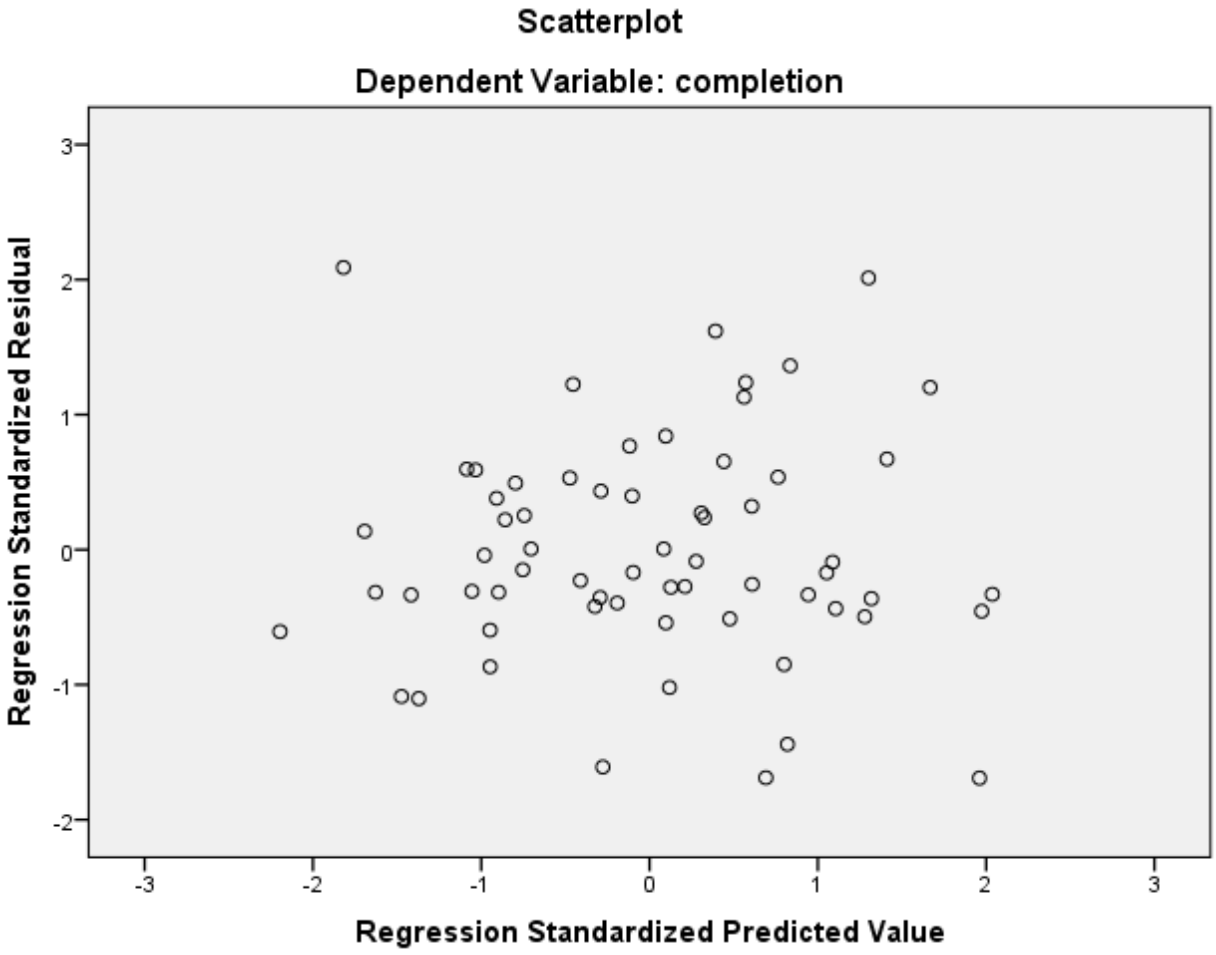
APPENDIX M

Scatterplot of the Standardized Residuals versus the Standardized Predicted Values in *Economics*



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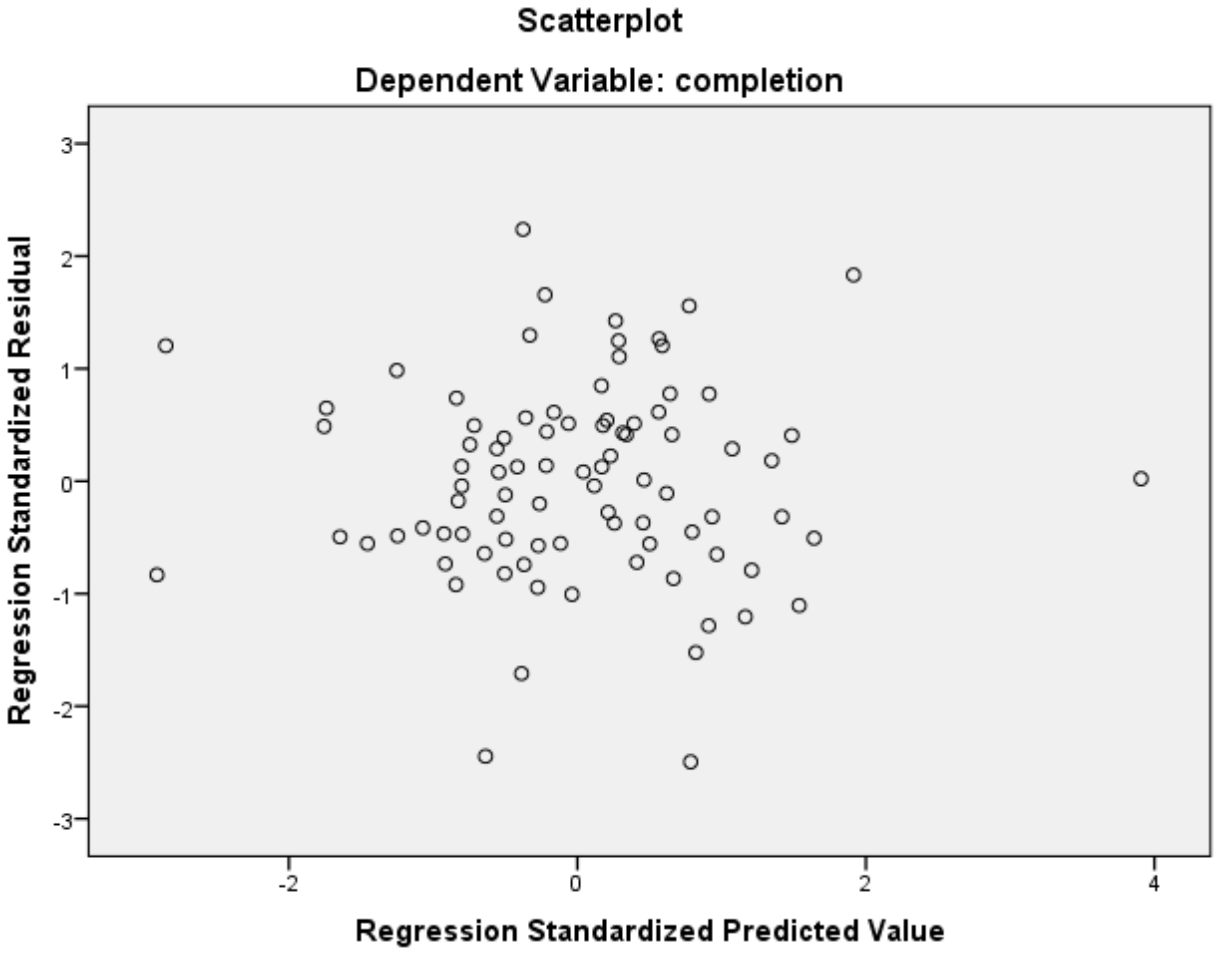
APPENDIX N

Scatterplot of the Standardized Residuals versus the Standardized Predicted Values in *English*



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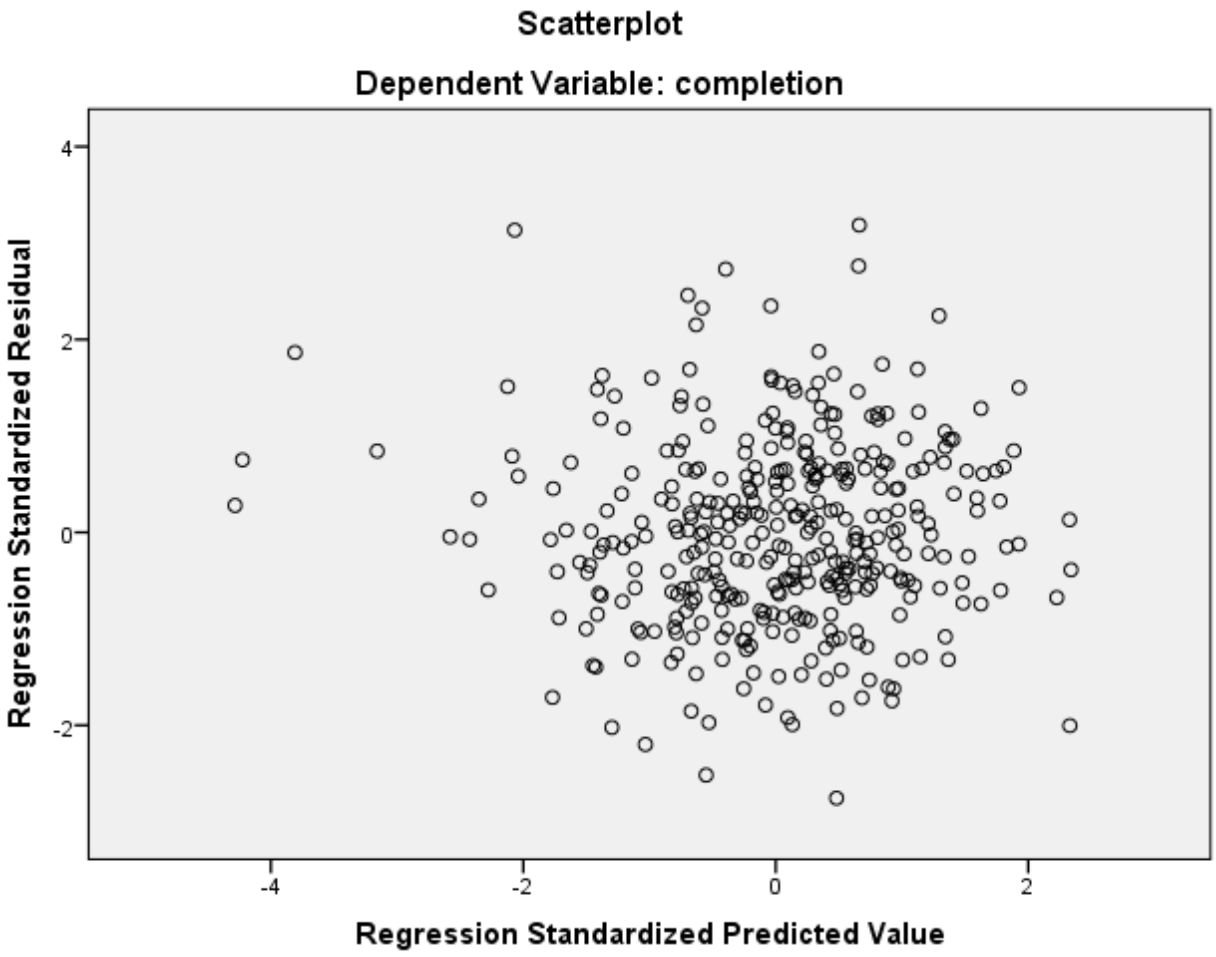
APPENDIX O

Scatterplot of the Standardized Residuals versus the Standardized Predicted Values for *All the Programs* in the dataset



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ABOUT THE AUTHOR

Angela Miller began her doctoral studies in 2005. She has her Masters degree in Piano Performance, and a dual Bachelor's degree in Psychology and Music. She was awarded the UG-Fellowship in 2005 and worked in Student Services at the University of South Florida prior to starting a family. She is married to Caleb Miller and has two children. In the future, she hopes to bridge her passion for music with her degree in education to become a Dean of a Music College.

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