Completion and Attrition in STEM Master's Programs

PILOT STUDY FINDINGS

CGS COUNCIL OF GRADUATE SCHOOLS

Completion and Attrition in STEM Master's Programs: Pilot Study Findings

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Suggested citation:

Council of Graduate Schools. (2013). Completion and Attrition in STEM Master's Programs: Pilot Study Findings. Washington, DC: Author.

ISBN-10 1-933042-40-0
ISBN-13 978-1-933042-40-4

FOREWORD

In 2004, the Council of Graduate Schools (CGS) launched the PhD Completion Project, a national initiative to examine and document doctoral completion and attrition rates and to study institutional factors and interventions designed to improve completion and reduce attrition. During this multi-year project, we developed a solid empirical understanding of doctoral completion and attrition, and fostered a national dialogue among key stakeholders, particularly among the deans of graduate schools, about the issue. That dialogue, and the success of our efforts to examine doctoral completion and attrition, convinced us that the time was right to begin an examination of completion and attrition in master's programs. Master's education is the largest and fastest growing part of the graduate education enterprise, and it is the component where women and minorities are in the majority. Master's education, particularly in science, technology, engineering, and mathematics (STEM) fields, is critical to preparing the workforce of the future, yet we lack key information regarding master's completion and attrition rates and factors that contribute to student success. A more thorough analysis of the role and status of the master's degree, particularly in STEM fields is necessary to address graduate degree production in the U.S. comprehensively and to begin to fill this gap that has long existed in master's education research.

As a first step, and with funding from the Alfred P. Sloan Foundation and the National Science Foundation, CGS began work on the Master's Completion Project in January 2009. The goal of this exploratory project was to clarify the current state of knowledge about completion and attrition in master's programs in STEM fields, to draw on current research to develop a better understanding about why students fail to complete, and to identify factors that contribute to successful completion. To accomplish this goal, CGS conducted a review of the literature on master's completion and attrition, collected and analyzed data on completion and attrition at the master's level, conducted research on the characteristics of master's programs, and facilitated a Dean Dialogue and a focus group on master's completion and attrition at the 2009 CGS Summer Workshop. The

findings of this research formed the basis of a white paper, "Completion and Attrition in Master's Programs in STEM," which served as a backdrop for an invitational workshop in May 2010 that was funded by the National Science Foundation. Following the workshop, and as the culminating work of the exploratory project funded by the Alfred P. Sloan Foundation, CGS published the monograph The Role and Status of the Master's Degree in STEM in 2010 (Council of Graduate Schools, 2010). This report presented the state of knowledge about master's education, with a focus on completion and attrition in STEM. The report illustrated the rapid growth and important role of master's degrees to workforce needs of the knowledge economy that emphasize globalism, creativity, adaptability, and diversity.

The enthusiastic responses to the exploratory project confirmed that there was interest and value in further pursuing this important area of graduate education. As a result, CGS launched a project titled Completion and Attrition in STEM Master's Programs with support from the Alfred P. Sloan Foundation. In this project, CGS worked with five U.S. partner institutions to take a closer look at STEM master's programs on their campuses, completion and attrition rates in those programs, and best practices for successful completion of students in those programs. The project also did a similar study of MBA programs at the same five institutions as a basis for comparison. This monograph, Completion and Attrition in STEM Master's Programs: Pilot Study Findings, describes the work and our findings, and proposes directions for future research on completion and attrition in STEM master's programs.

Debra W. Stewart
President, CGS

ACKNOWLEDGMENTS

This publication was made possible by the generous support of the Alfred P. Sloan Foundation, a long-standing champion of science master's education. In particular I want to thank Ted Greenwood for his encouragement and assistance in conceiving the project at the early stages of its implementation. Also, Elizabeth Boylan, the current project officer, deserves special recognition for her continued support for the project.

I also want to thank many individuals for their commitment to bringing the project to fruition. The research design used for the project was constructed with input from an Advisory Group composed of seven distinguished graduate deans, including Charles Betsey (Howard University), Brenda Brouwer (Queen's University), Peter Dorhout (Colorado State University), Moheb Ghali (Western Washington University), Lorna Moore (Wake Forest University), Robert Roer (University of North Carolina, Wilmington), and James Wimbush (Indiana University). It is a pleasure to recognize them here for their contribution in shaping the project at its inception.

The selection of research partner institutions was informed by an equally distinguished Selection Advisory Committee, which included Robert Augustine (Eastern Illinois University), Andrew Comrie (University of Arizona), Nancy Marcus (Florida State University), Charles Rozek (Case Western Reserve University), and Janet Rutledge (University of Maryland, Baltimore County). I thank them for their contributions to the project.

This project would not have been possible without the contributions from all five of our research partner institutions and their graduate deans: Sam Attoh (Loyola University Chicago), Karen Butler-Purry (Texas A&M University), Andrew Hsu (Wright State University), M.J.T. Smith (Purdue University), and Jerry Weinberg (Southern Illinois University Edwardsville). Each of these graduate deans served as the Principal Investigator of this project, and I am grateful to them and their graduate school staff for their support of and assistance with all aspects of

this project. I also extend a special word of thanks to Sam Attoh (Loyola University Chicago) and R. William Ayres (Wright State University) for reviewing the draft report.

I am grateful to the hundreds of former and current graduate students, faculty, and administrators from each of the five research partner institutions who participated in the various data collection efforts and provided the data on which this report is based. I also thank the staff and students at Howard University, the University of Maryland College Park, and the University of Maryland Baltimore County for piloting the data collection instruments.

It is also fitting that I recognize the contributions of the CGS staff, consultants, and former staff. I especially want to recognize and thank Jeff Allum, Sheila Kirby, Robert Sowell and Leila Gonzales for their devoted efforts to the project and the production of this publication. I also thank Nathan Bell for his leadership in the early stages of the project. A number of CGS staff members, in particular Jeannette Remington, Nate Thompson, Daniel Denecke, Julia Kent, and Mike Carver, deserve recognition for the roles they played in the production of this publication. Finally, thanks to Jennifer Sloan McCombs of the RAND Corporation for her input on the initial research design.

Debra W. Stewart
President, CGS

CHAPTER 1. INTRODUCTION

"The master's degree cannot be defined in any exact terms that will include all kinds and varieties that are awarded by all kinds of educational institutions ... The qualifications that need to be met by the candidate vary from nothing definite to stern unyielding standards. The degree is awarded lavishly at this institution and reluctantly at that one. If one attempts to survey and classify the procedures in vogue, he is lost in a maze of varying requirements. There are no exceptions because there is no rule; a point midway between extremes is not an average; and a college at that point in one respect may be extreme in another."

Irwin Buell, 1944 (p. 400)

Preparing talent at the master's-level in science, technology, engineering, and mathematics (STEM) fields is crucial to ensuring that the U.S. can meet the challenges of the 21st century. As detailed by The Path Forward: The Future of Graduate Education in the United States (Wendler et al., 2010), the competitiveness of the U.S. in the global economy hinges fundamentally on the ability of this nation to produce sufficient numbers of individuals with graduate degrees who have the advanced training and critical thinking skills that will drive innovation and solve complex problems.

While the demand for current and future master's degree holders has attracted substantial attention in recent years, much less consideration has been given to the extent to which entering master's students actually succeed in completing their program of study. Empirically speaking, rates of completion and attrition in master's programs, and the factors that contribute to the successful completion of master's programs, are not well understood. Only two multi-institution and multi-field comparative studies can attest to master's completion and attrition rates, neither of which were conducted in the United States (Canadian Association of

Graduate Studies, 2004; Martin, Maclachlan, & Karmel, 2001). Although a handful of U.S.-based studies (Ghali & Mor, 2010; Lightfoot & Doerner, 2008; Matchett, 1988; Mathis, 1993; Nelson, C.V., Nelson, J, & Malone, B., 2004) examined master's-level completion and attrition, none of them were national in scope. Instead, they explored master's completion and attrition for individual programs, at particular institutions, or for certain population groups. Important as these and other research efforts have been in their own rights, none of them were generalizable and all of them seemed to suggest that there was good reason to learn more about master's completion at the national level.

The lack of empirical evidence concerning master's completion and attrition can be explained in part by the fact that master's education is a large and diverse enterprise, one that can take a number of forms (Council of Graduate Schools, 2010). Stand-alone master's programs are those programs into which students are directly admitted. Such programs may be offered alongside doctoral programs in the same field, or may be the highest degree offered in a particular field at a given institution. Stand-alone programs differ in terms of various programmatic characteristics, and may also be partner programs in a dual degree or accelerated degree model. In addition, stand-alone programs may be research-oriented or professional/practitioner-oriented.

A second category of master's programs are research-based master's programs. These programs are either designed to prepare students for further study at the doctoral-level or to prepare students to enter research careers with a master's-level credential. Master's degrees earned en route to the PhD originate from programs that may or may not admit students directly into the master's program. However, the stated goal of students in these programs is to earn a PhD. In en route master's programs, PhD degree-seeking students may be awarded the master's degree along the way to the PhD, whether or not that ultimate destination is actually reached. En route programs vary in admission restrictions, and mechanisms by which students provide evidence to merit the award of the master's degree may vary.

Dual degree programs culminate in the award of two master's degrees. Characteristics of master's programs that are partners in dual degree arrangements show considerable variability in terms of academic requirements for the award of the degree, administrative rules governing the program, and program delivery approaches. In some cases the number

of credits required is shared between the programs, resulting in the total number of credits required being less than would be necessary for two stand-alone degrees.

Accelerated master's degrees are those that have been closely coordinated with a bachelor's degree program in the same or a closely related field. Accelerated master's degree program characteristics vary considerably as well. For example, some accelerated master's degree programs share a common set of credits thereby reducing the number of required credits.

Master's programs can also be described according to a number of other characteristics, which can vary across and within institutions. Thesis programs may exist alongside non-thesis programs. Purely online programs and programs that provide face-to-face instruction may be housed within a single department. Some programs may employ a cohort model in which all students start and complete the program at the same time, while others may allow students to commence studies at any point during the calendar year. Time limits to complete the degree also vary between institutions and programs, with some institutions implementing a time limit of anywhere from two to seven years to complete the program. Some institutions may require students to study full-time, while others permit part-time study.

Rationale for the Study

Filling the empirical void with respect to master's completion and attrition rates and factors contributing to degree completion is important for a number of reasons, not the least of which is that so many U.S. citizens are enrolled in master's programs. Master's education represents the largest portion of the graduate education enterprise, accounting for 75% of all graduate students enrolled and 89% of all graduate degrees awarded (Allum, Bell, & Sowell, 2012). Roughly eight percent of the U.S. population 25 years of age and over had a master's degree as their highest degree in 2011 (Snyder & Dillow, 2012), and another 1.3 million students were enrolled in master's programs in the U.S. as of the Fall of 2011 (Allum, Bell, & Sowell, 2012).

Master's education is also the fastest growing component of graduate education. Across all fields, the number of master's degrees

awarded increased 110% between academic years 1989-90 and 2009-10, from about 330,000 to more than 693,000 (Snyder & Dillow, 2012). This compares with a 53% increase in the number of doctorates and first-professional degrees awarded over the same time period. In science, technology, engineering, and mathematics (STEM) fields, the number of master's degrees awarded increased 110% over this time period, from about 101,000 in academic year 1989-90 to over 212,000 in academic year 2009-10 (National Science Foundation, 2012).

Furthermore, women and underrepresented students comprise the majority of all master's degree recipients. Women earned 60% of all master's degrees awarded in academic year 2009-10, including nearly two-thirds (65%) of master's degrees in social and behavioral sciences, 56% of master's degrees in the biological and agricultural sciences, and 43% of master's degrees in physical and earth sciences (Bell, 2011). Underrepresented students, including U.S. citizens and permanent residents who are either Black/African American, Hispanic/Latino/Latina, or Native American/Alaska Native, earned 14% of the master's degrees awarded in STEM fields in academic year 2009-10 (National Science Foundation, 2012).

Finally, master's degrees create professional advancement opportunities for millions of Americans. Nearly 5.7 million scientists and engineers who are employed in the U.S. hold a master's degree as their highest degree (National Science Foundation, 2012). They work in every sector of the U.S. economy, and perform a range of roles, including management, professional services, teaching, and research. Individuals who hold a master's degree also enjoy lower levels of unemployment. In 2012, among individuals over 25 years of age, the unemployment rate for individuals with master's degrees was 3.5%, compared with 4.5% percent for those with bachelor's degrees and 6.8% percent for all workers (Bureau of Labor Statistics, 2013). Finally, individuals with master's degrees typically earn more than individuals with lower levels of educational attainment. In 2011, the median annual earnings of individuals with master's degrees was $65,676, compared with $54,756 for individuals with a bachelor's degree (Bureau of Labor Statistics, 2012). Over the course of their working lifetimes, master's degree holders will earn a median $2.67 million, compared with $2.27 million for bachelor's degree holders (Carnevale, Rose, & Cheah, 2011). Lifetime earnings vary considerably by occupation, with those in managerial/professional occupations and STEM

occupations earning more than their counterparts in health professions, education, and other occupations.

In an effort to address the lack of understanding about master's completion and attrition, CGS launched an exploratory study in January 2009. With funding from the Alfred P. Sloan Foundation and the National Science Foundation, CGS assembled thought leaders to clarify the state of knowledge about master's completion and attrition in STEM fields using extant research. The project also sought to develop a typology of the characteristics of STEM master's programs, to identify factors that contribute to successful master's degree completion, and to better understand why students fail to complete master's programs in STEM. The study found a range of completion rates, and some potentially significant differences by fields and subpopulations. Although the data from these institutions are not directly comparable due to differing methodologies, the project validated the paucity of data on completion and attrition at the master's-level, as well as the need for a thorough analysis of completion and attrition patterns across STEM fields and student populations, as well as the factors that affect students' success in master's programs (Council of Graduate Schools, 2010). The outcome was a clearly articulated need for a larger study that would collect completion and attrition patterns across STEM fields and student populations and examine factors that affect students' success in master's programs.

In October 2010, CGS received a grant from the Alfred P. Sloan Foundation to launch a pilot project that would build upon and expand the work of the exploratory project. This project, Completion and Attrition in STEM Master's Programs, focuses on three main issues: (1) the factors affecting students' decisions to enroll in masters' programs in a selected set of fields; (2) completion and attrition rates in master's programs in these selected broad fields and the factors influencing completion and attrition; and (3) institutional structures and practices designed to attract, retain, graduate, and support master's students. For the purpose of this project, STEM fields included biological and agricultural sciences, engineering, mathematics and computer sciences, physical and earth sciences, and social and behavioral sciences. Specifically, the study was designed to address four main research questions:

1. What are the characteristics of science, technology, engineering, and mathematics (STEM) master's programs?

2. What are the completion and attrition rates in master's programs across STEM and other selected fields (i.e., MBA) at a small number of CGS member institutions? How do completion and attrition rates vary by fields, gender, citizenship and race/ethnicity and other program characteristics?

3. What are the reasons students enroll in masters' programs and how do these vary across fields and programs? What factors, including student and program characteristics, appear to be related to students' success or lack of success in completing master's programs?

4. If current completion and attrition rates vary considerably across programs, fields, or subgroups of students, can we identify promising practices to help improve outcomes?

This pilot study builds from the work of its forerunner, CGS' PhD Completion Project. This effort was a national initiative that examined and documented doctoral completion and attrition rates as well as institutional factors and interventions designed to improve completion and reduce attrition. As a result of the project, CGS developed an empirical process for understanding doctoral completion and attrition, and fostered a national dialogue among key stakeholders, particularly the deans of graduate schools, about the issue. The project uncovered a considerable body of existing research, dating as far back as the 1950s, on the subject of completion and attrition at the doctoral-level. One of the major findings of the analysis was that about 57% of doctoral students complete their program of study within a ten-year timeframe (Council of Graduate Schools, 2008).

Participating Institutions

At the inception of the project, CGS appointed a seven-member Advisory Group to refine the research design and help determine the types of master's programs and the fields that should be included in the study. The Advisory Group also assisted in framing a Request for Proposals (RFP) intended to solicit proposals from which five institutions would be selected to participate in the project. Among other things, applicants must

have enrolled a minimum of ten new students in each of five required (or core) degree programs in each of academic years 2003-04 through 2010-11: biological and biomedical sciences, computer and information sciences, mathematical sciences, psychology, and business administration (MBA). These requirements were put in place in order to ensure some comparability of programs across the funded research partner institutions, and to ensure enough data for analysis. As will be discussed in more detail in Chapter Two, these five core degree programs served only as a threshold for consideration in the selection process. Once institutions were selected, CGS invited research partner institutions to provide data on all STEM master's programs, as well as the MBA program. Institutions submitting proposals were also required to commit to providing data for students enrolled in all other STEM master's programs at their institution from 2003-04 through 2010-11, provided that the programs met the enrollment threshold of a minimum of 10 new students per program per year. Institutions could opt to include smaller programs that did not meet the enrollment threshold, but were not required to do so.

The RFP was issued to the more than 500 CGS member institutions (excluding purely online institutions), and, with the help of a Selection Advisory Committee, CGS selected five institutions to serve as research partner institutions: Loyola University Chicago, Purdue University, Southern Illinois University Edwardsville, Texas A&M University, and Wright State University. As illustrated in Table 1.1, four of the five institutions were research institutions, and one was master's-focused institution. Four institutions were public institutions, and one was a private not-for-profit institution. Four institutions were located in the Midwest, and one was in the South.

The total number of master's programs at the five research partner institutions ranged from 45 to 149. The total number of graduate students enrolled in these institutions ranged from about 2,300 to nearly 9,500, while enrollment in master's programs ranged from about 2,140 to more than 5,500. Among the master's students at these five institutions, women were a varying share of the enrollment, ranging from 31% of all master's students at Purdue University to 69% at Loyola University Chicago. The share of students who were underrepresented students (Black/African American, Hispanic/Latino/Latina, Native American/Alaska Native) ranged from seven percent to 17%, while the share of international students ranged from eight percent to 34% (see Table 1.1).

Table 1.1. Profile of Funded Research Partners

Institution	Institution Type	Carnegie Classification*	Number of Master's Programs	Number of Graduate Students (Fall 2011)	Number of Students in Master's Programs (Fall 2011)	Among Master's Students in Fall 2011:		
						Women (%)	Underrepresented (%) **	Non-U.S. Citizens on Temporary Visas (%)
Loyola University Chicago	Private	RU/H	84	4,731	3,875	69%	16%	8%
Purdue University	Public	RU/VH	93	7,937	3,176	31%	7%	34%
Southern Illinois University Edwardsville	Public	Master's L	45	2,289	2,142	61%	12%	11%
Texas A&M University	Public	RU/VH	149	9,473	5,530	41%	17%	32%
Wright State University	Public	RU/H	70	3,943	3,100	58%	11%	10%

* RU/VH = Research Universities (very high research activity). RU/H = Research Universities (high research activity). Master's L = Master's Colleges and Universities (larger programs). ** Underrepresented students include students who are Black/African American, Hispanic/Latino/Latina, and Native American/Alaska Native.

Organization of this Report

This report documents the results of the pilot project. The next chapter provides an overview of the data and methods (a more detailed description of data and methods appears in Appendix A). Chapter Three describes the results of the analysis of completion and attrition data provided by the five research partner institutions, including completion rates, attrition rates, median time-to-degree, and median time-to-attrition. The chapter begins with a description of these data within STEM fields (which include biological and agricultural sciences, engineering, mathematics and computer sciences, physical and earth sciences, and social and behavioral sciences), followed by a comparison between STEM fields and MBA programs. Student perspectives are described in Chapter Four, which describes enrollment characteristics, reasons for enrolling in master's programs, future aspirations of students, sources of financial support (as well as debt burden), and student opinions about program improvements. Chapter Five describes institution and program perspectives, including selection and admissions and advising and mentoring practices, financial support, curricular structures, academic and non-academic supports. Factors contributing to completion of master's programs are described in Chapter Six, followed by a discussion about promising practices and suggestions for future research in Chapter Seven.

CHAPTER 2. DATA AND METHODS

The Completion and Attrition in STEM Master's Programs project was a pilot study intended to describe completion and attrition rates among students in science, technology, engineering, and mathematics (STEM) master's programs, and identify factors that contribute to the successful completion of a STEM master's degree. The project also collected and analyzed data regarding Masters of Business Administration (MBA) programs to provide a comparison group. This chapter provides an overview of the data and methods used in the study. A more detailed description of the data and methods, including the procedures and outcomes of the data collection effort, can be found in Appendix A.

Data Collection and Analysis

Data collected from the five research partner institutions included: (1) de-identified student-level completion and attrition data for individuals entering STEM master's programs and MBA programs between academic years 2003-04 and 2010-11; (2) information on the characteristics of the programs participating in the project, including enrollment figures, degree requirements, and the mode of delivery, among other characteristics; (3) a survey of graduate programs directors of each of the programs participating in the project, which included information about financial support, admissions processes, mentoring and advising practices, and academic support, among other variables; (4) site visits to each of the research partner institutions, during which CGS project staff conducted focus groups with master's students and group interviews with graduate deans, graduate program directors, and other university personnel; (5) online surveys of first-year students, graduating students, and students who stopped out or dropped out of master's programs; and, (6) narrative

reports submitted by the five research partner institutions.

For the purpose of this project, STEM fields of study included: biological and agricultural sciences, engineering, mathematics and computer sciences, physical and earth sciences, and social and behavioral sciences. It should be noted that public administration was also initially included in the list of STEM fields. The CGS project team chose to exclude public administration from the analysis of de-identified student-level completion and attrition data because only four of the five research partner institutions had such programs. All other forms of public administration-related data collected by the CGS research team (i.e., program characteristics, survey results, and site visit findings) were included in the final analysis, allowing this report to reflect the full range of programs and student experiences across all institutions. This introduces a small discrepancy in the final findings, but it was a necessary step in protecting the confidentiality of all five research partner institutions and study participants. Furthermore, given that this was a pilot study, the additional insights gained by the inclusion of public administration data in the aggregated analyses outweigh the inconsistency.

With the advice of the project Advisory Group, as well as insights gained from the body of literature regarding graduate students and factors affecting completion and attrition, the CGS project staff and a consultant with expertise in qualitative research developed data collection elements for the six categories of data collection listed above. These data elements were framed, in part, by definitions of various student populations. For the purpose of this study, "first-year students" were defined as students who entered a master's program in academic year 2011-12, while "graduating students" were defined as students who were completing a master's program in academic year 2011-12. Students who were still in a master's program but who had taken a formal or informal leave of absence from the program (i.e., students who were not actively enrolled in courses or were not working on a thesis as of Spring 2012 but had not exceeded the time limit for the degree) were referred to as "stopouts." Students who had formally or informally withdrawn from a master's program in academic years 2011-12, 2010-11, or 2009-10 for reasons other than academic reasons (i.e., they had voluntarily dropped out of the program) were referred to as "dropouts." There could have been overlap between

stopout and dropout students, especially if the student failed to notify the program or institution about the decision to withdraw.

The CGS project team developed eight data collection instruments. The student-level characteristics template collected de-identified student-level data such as demographic characteristics, undergraduate history, program name, date of enrollment, and current enrollment status. The program characteristics template collected information such as total enrollment, program requirements, policies, and mode of delivery. The Survey of Graduate Program Directors included program-specific questions such as program policies and requirements, advising practices, types of academic and non-academic supports, and the availability of professional development opportunities. Focus group protocols for first-year and graduating students included questions intended to elicit reasons for pursuing a master's degree, and explain experiences with advising, financing, program expectations, and program environment among other things. The Survey of First-year Master's Students included questions about enrollment decisions, advising, financing and debt, professional development opportunities, milestones and expectations, and demographic characteristics, among other items. The Survey of Graduating Master's Students and the Stopout/Dropout Survey asked questions that were similar to the Survey of First-year Students, and accounted for the fact that the individuals being surveyed had a different relationship with the institution than first-year students. These instruments are described in more detail in Appendix B.

Prior to implementation, the data collection elements were mapped back to the project's research questions to ensure that the data being collected were indeed germane to the study. The CGS project staff also pilot tested the draft student survey questionnaires and draft focus group protocols at three local universities that did not submit proposals to participate in the project: Howard University, the University of Maryland Baltimore County, and the University of Maryland College Park.

Overall, data collected by this project provide the first-ever multi-university, multi-field portrait of master's completion and attrition in the U.S., and include:

- De-identified student-level completion and attrition records for 21,291 master's students
- Program characteristics describing 191 individual master's programs
- Online survey responses from 177 graduate programs directors
- Focus group sessions with 143 first-year and graduating master's student participants
- Group interviews with 109 graduate deans, graduate program directors, and other university personnel
- Online survey responses from 948 first-year master's students
- Online survey responses from 968 students completing master's degrees in 2011-12
- Online survey responses from 308 students who stopped out or dropped out of master's programs during the preceding three academic years
- Final narrative reports submitted by the five research partner institutions

Analytical Techniques

Given that this was a pilot project with a purposive sample, the CGS project team used simple cross-tabulations and frequencies to analyze student-level data on completion and attrition and responses to the student surveys. Because of small sample sizes in some institutions, and because of the need to maintain the confidentiality of respondents, the CGS project team did not report data disaggregated by institution. Qualitative research methods were used to analyze the open-ended responses from the surveys, as well as responses to questions posed during the focus group and group interviews sessions. The main purpose of these analyses was to examine: (1) student experiences as they went through their programs; (2) students' perceptions about the positive and negative aspects of their programs; (3) their opinions and suggestions for program improvement; and (4) what the institutions had implemented or were considering implementing to help improve student outcomes.

The de-identified student-level completion and attrition records were comprised of eight cohorts of students who entered master's degree

programs between the academic years 2003-04 and 2010-11. Students were assigned to a cohort based on the academic year in which they entered their master's degree program. Two-year, three-year, and four-year completion rates were calculated for the first four student cohorts (i.e., 2003-04 through 2006-07). Six-month, one-year, and two-year attrition rates were calculated for the first six student cohorts (i.e., 2003-04 through 2008-09). These points of time were selected because initial analyses revealed that completion and attrition rates appeared to peak at these particular periods.

Median time-to-degree and median time-to-attrition were calculated for each student by calculating the number of months that transpired between the actual starting month and year, and the month and year of completion or attrition. Median time-to-degree and median time-to-attrition were calculated for all students within the analysis cohorts. For example, in the case of the completion cohorts, the median time-to-degree value was calculated from all students entering programs from 2003-04 through 2006-07. Median time-to-attrition was calculated for all students entering programs from 2003-04 through 2008-09.

Program Characteristics

To understand the characteristics of master's programs, the five research partner institutions provided programmatic data on all master's programs that were in the five core programs of study used in the research partner selection process (i.e., biological and biomedical sciences, computer and information sciences, mathematical sciences, psychology, and MBA), as well as programmatic data on all other STEM master's programs.

Table 2.1 presents the distribution of programs by institution. Over two-fifths (44%) of the programs were at Texas A&M University, and roughly one-fifth (19%) of the programs were at Purdue University. The other institutions accounted for between 10% and 16% of the programs.

Table 2.1. Distribution of Programs by Institution

Institution	Number	Percent of Total
Loyola University Chicago	19	10%
Purdue University	37	19%
Wright State University	30	16%
Southern Illinois University Edwardsville	21	11%
Texas A&M University	84	44%
Total	191	100%

Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database
NOTE: Percent of total may not equal 100% due to rounding

Table 2.2 illustrates the distribution of programs by field of study. One-third (33%) of the programs were in biological and agricultural sciences, and another 30% were in engineering. Twelve percent of programs were in social and behavioral sciences, 11% were in physical and earth sciences, while another nine percent were in mathematics and computer sciences. MBA programs accounted for the smallest shares of the programs (four percent).

Table 2.2. Distribution of Programs by Field of Study

Field of Study	Number	Percent of Total
Biological and Agricultural Sciences	62	33%
Engineering	57	30%
Social and Behavioral Sciences	23	12%
Physical and Earth Sciences	21	11%
Mathematics and Computer Sciences	17	9%
MBA	7	4%
Total	191	100%

Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database
NOTE: Percent of total may not equal 100% due to rounding

Study Parameters and Limitations

This project was a pilot study, one that was deliberately narrow in its focus on completion and attrition issues using a nonrandom and limited set of institutions and programs. As such, the findings are not generalizable to the full range of institutions or programs offering master's degrees. For instance, the study was restricted to focus only on those master's programs that were stand-alone (i.e., terminal) programs, primarily to keep the complexity and variability of the study manageable. Specifically, the project excluded dual degree programs, accelerated programs, master's degrees earned en route to a PhD, and purely on-line master's programs.

Because this was a census sample, not a randomly-selected sample and because it was not possible to collect information from non-respondents, the CGS project team decided against using statistical techniques to correct for over- or underrepresentation (for example, by weighting the responses of some institutions or group of respondents more heavily). In particular, Texas A&M University accounted for a large share of the programs and respondents, but techniques to correct for this imbalance were not applied. Thus, the findings reflect the experiences and opinions of students who responded to the surveys rather than the targeted populations.

Self-reported data are subject to several well-known biases. In addition, the CGS project team is cognizant of the fact that, at the time of data collection, respondents to the Survey of First-year Master's Students and Survey of Graduating Master's Students, and participants in the student focus group sessions had not yet completed their master's programs, and the answers regarding the factors that contribute to their ability to complete their master's degree were necessarily speculative. Nor did the period of the study (27 months) allow for a rigorous or longitudinal examination of several important issues, such as: (1) the relationship between student motivations, expectations, and academic outcomes; (2) subsequent employment outcomes; and (3) return on investment for different types of master's degrees. While all of these issues are important to understand, this study was a pilot project designed to yield a broad brush portrait of the patterns of enrollment, completion, and attrition in master's programs and identify what institutions and programs can and should do to improve outcomes and foster student success. The findings reported here offer valuable insights into these issues.

CHAPTER 3. COMPLETION AND ATTRITION TRENDS

There is certainly virtue in calculating aggregate completion and attrition rates. The fact that CGS' PhD Completion Project, for instance, reported a 57% 10-year completion rate for PhD students (Council of Graduate Schools, 2008) offers an important benchmark from which institutions and PhD programs can inform self-evaluations. This pilot project calculated similar aggregate completion rates, and like the PhD Completion Project, calculated completion rates and attrition rates for various subpopulations. It is important to know, for example, whether or not there are differences by gender, citizenship, race/ethnicity, and age. Such differences may be indicators of parity (or non-parity) between various demographic groups and lead to specific institution or program-level interventions. It is also important to know if there are differences by broad field of study for the same reason.

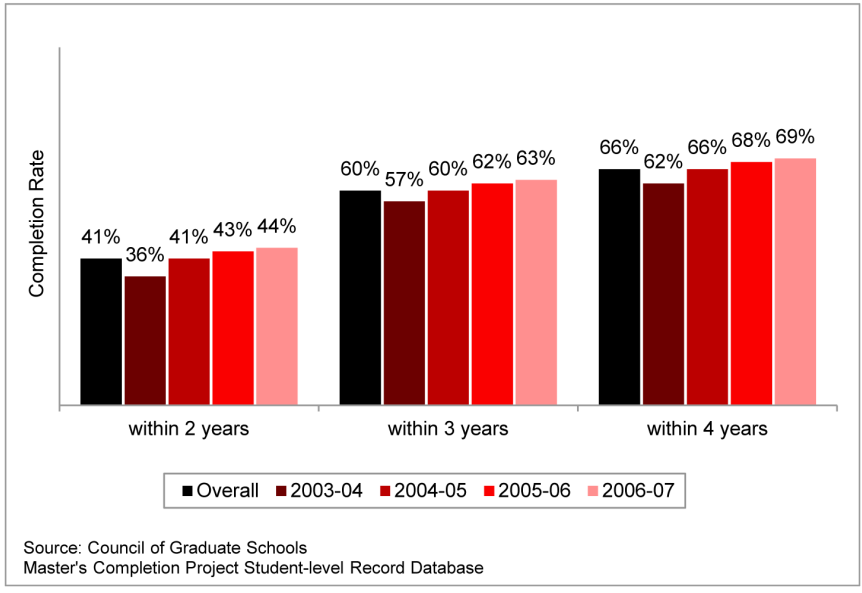
This chapter documents the completion and attrition trend analyses of the student-level data submitted by the research partner institutions. The following sections present findings related to differences in completion and attrition rates among cohorts, fields, and various demographic characteristics at each time period for students in the following science, technology, engineering, and mathematics (STEM) fields: biological and agricultural sciences, engineering, mathematics and computer sciences, physical and earth sciences, and social and behavioral sciences. In addition, a comparison of completion and attrition rates and median time-to-degree and time-to-attrition of students in STEM and MBA programs is presented in the last section of this chapter.

Completion Rates in STEM Programs

Completion Rates by Cohort

The data used in the analysis of completion rates by cohort consisted of 9,186 students distributed evenly across four cohorts as follows: 2003-04 (26%), 2004-05 (25%), 2005-06 (24%), and 2006-07 (25%). As Figure 3.1 illustrates, 41% of STEM students graduated within two years of entering their master's degree programs. By the end of the fourth year, completion rates for STEM students increased to 66%. The largest increase in overall completion rates (19 percentage points) occurred between the two- and three- year time period. Cumulative four-year completion rates varied by institution, from a low of 58% to a high of 78%, a difference of 20 percentage points. Completion rates by individual student cohorts increased by six to eight percentage points between the 2003-04 and 2006-07 cohorts. The consistency of the data over four cohorts is striking, and begs the question: why have completion rates improved so consistently between 2003-04 and 2006-07? Are these improvements the result of institution-specific interventions, program-specific improvements, or student attributes and commitment?

Figure 3.1. Cumulative Completion Rates by Student Cohort, STEM



Completion Rates by Broad Field of Study

The data used in the analysis of completion rates at the broad field level were distributed as follows: biological and agricultural sciences (18%), engineering (53%), mathematics and computer sciences (12%), physical and earth sciences (five percent), social and behavioral sciences (13%). Of all STEM fields, students in the physical and earth sciences had the lowest completion rates (33%) at the two-year time period; however, they had the largest increase in completion rates (26 percentage points) between the two- and three-year time periods (see Table 3.1). At the other end of spectrum, students in the social and behavioral sciences had the highest completion rates at the two-year time period (45%), and the lowest increase (15 percentage points) in completion rates between the two- and three-year time periods. By three years after the start of their master's program, 60% of all STEM students completed their degrees. By four years after beginning their course of study, 66% of STEM students graduated. The lack of substantial differences across broad fields of study, particularly at the three- and four-year levels suggests that STEM fields may not be as different from one another after all.

Completion Rates by Gender

Women comprised just over one-third (34%) of the students. Overall, women had higher completion rates than men by four percentage points at each time period (see Table 3.1). For example, at the two-year completion period, 43% of women had completed their degrees while only 39% of men had done so. Between the two- and three-year time periods completion rates increased markedly for both genders by 20 percentage points. By four years after beginning their course of study, 69% of women and 65% of men had graduated from their STEM programs. Among the five partner institutions, cumulative four-year completion rates ranged from 62% to 78% for women (a 16 percentage point difference), and from 53% to 78% for men (a 25 percentage point difference). This finding suggests an emerging opportunity for STEM graduate programs in recruiting an underrepresented population that is more likely to complete their program of study.

Completion Rates by Race/Ethnicity

The data used in the analysis of completion rates by race/ethnicity consisted of 5,458 students distributed as follows: White (83%), Asian/Pacific Islander (6%), and Black/African American (5%), and Hispanic/Latino/Latina (6%). Because of small sample sizes, students whose race/ethnicity was either Native America/Alaska Native, two or more races, or unknown were excluded.

Asian/Pacific Islander students had the highest completion rates of any race/ethnicity category, followed by White students (see Table 3.1). Black/African American students had the lowest completion rates across all categories, and this was primarily driven by the lower two-year completion rate (32%) and the small increase in completion rates between the three- and four-year time periods (four percentage points). All race/ethnicity groups had an increase of 18 to 19 percentage points between the two- and three-year completion rate categories, and an increase of four to eight percentage points between the three- and four-year time periods. The fact that Hispanic/Latino/Latina and Black/African American master's students complete at lower rates should be a reminder that more can be done to make sure that these students achieve levels of success that are comparable to the population as a whole. Differences in cumulative four-year completion rates by institution were calculated, but because of the low numbers of students in some categories the findings were not deemed reportable.

Completion Rates by Citizenship

The data used in the analysis of completion rates by citizenship consisted of 9,186 students, 63% of whom were U.S. citizens and permanent residents, and 37% of whom were temporary residents. Temporary residents had higher completion rates across all time periods by six to nine percentage points than U.S. citizens and permanent residents (see Table 3.1). At the two-year completion period, 44% of temporary residents had completed their degrees while only 38% of U.S. citizens and permanent residents had done so. Between the two- and three-year time periods, completion rates increased about 20 percentage points for both cohorts. By four years after beginning their course of study, 70% of temporary residents graduated from STEM programs, ranging from a low of 63% to a high of

83% among the five research partners. Similarly, 63% of U.S. citizens and permanent residents had graduated from their STEM programs within four years, ranging from 49% to 77% among the five research partners. The fact that temporary residents complete at higher rates may be explained by motivations to return to their home country after graduation, and/or the fact that their status as a temporary resident is only possible during the program of study.

Completion Rates by Age Group

The data used in the analysis of completion rates by age groups consisted of 9,182 students distributed as follows: 20-24 years old (56%), 25-29 years old (27%), 30-34 years old (nine percent), and 35 years and older (eight percent). The youngest age group (20-24 years old) had the highest completion rates across all time periods, while the oldest cohort (35 years and older) had the lowest completion rates (see Table 3.1). At the two-year completion period, 46% of 20-24 year olds had completed their degrees while only 22% of those students 35 years or older. The increase in completion rates between time periods was 16 to 21 percentage points between the two- and three-year transition and four to nine percentage points between the three- and four-year time periods. By four years after beginning their course of study, 71% of students in the youngest cohort (20-24 years old) and 47% of students in the oldest cohort (35 years and older) had graduated from their STEM programs. Although the CGS project team calculated differences in cumulative four-year completion rates by age group among the five research partner institutions, the findings are not reported because of the small numbers of students in some categories. The fact that younger students complete their program of study at higher rates than the older groups of students is one of the strongest and most consistent findings in this report. Although age in-and-of-itself cannot be identified as a factor contributing to completion, the roles and responsibilities of master's students at different points in their lives may.

Attrition Rates in STEM Programs

Attrition Rates by Cohort

The data used in the analysis of attrition rates by cohort level consisted

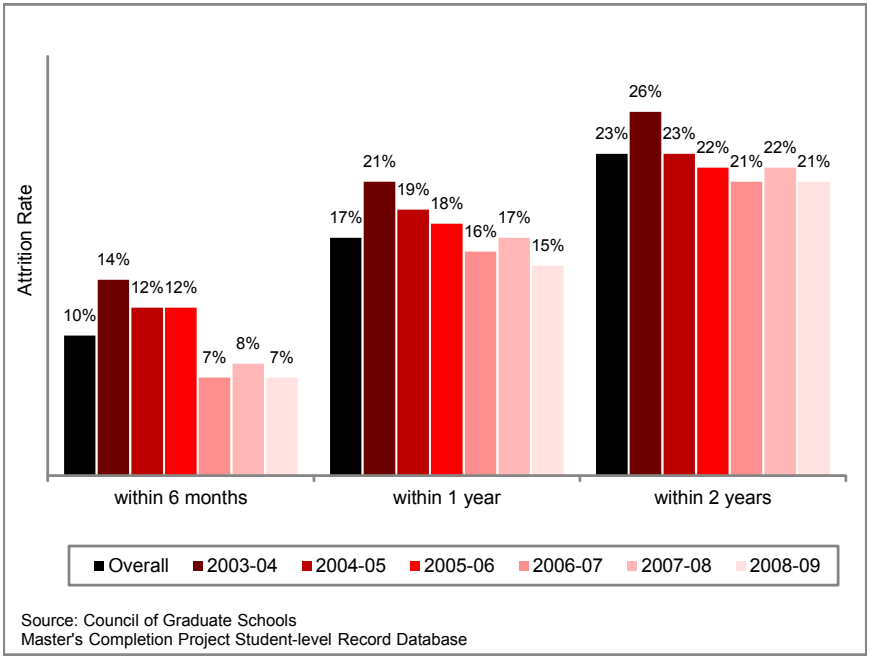
Table 3.1. Cumulative Completion Rates for STEM Students

	within 2 years	within 3 years	within 4 years
Overall	41%	60%	66%
Field of Study			
Biological and Agricultural Sciences	40%	62%	69%
Engineering	40%	60%	65%
Mathematics and Computer Science	40%	59%	66%
Physical and Earth Sciences	33%	59%	67%
Social and Behavioral Sciences	45%	60%	65%
Gender			
Women	43%	63%	69%
Men	39%	59%	65%
Race / Ethnicity			
White	39%	57%	64%
Asian / Pacific Islander	43%	62%	69%
Black / African American	32%	51%	55%
Hispanic / Latino / Latina	34%	52%	60%
Citizenship			
U.S. Citizen / Permanent Resident	38%	57%	63%
Temporary Resident	44%	66%	70%
Age Group			
20-24 years old	46%	67%	71%
25-29 years old	37%	56%	63%
30-34 years old	33%	51%	57%
35 years and older	22%	38%	47%

Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database

of 14,246 students distributed evenly across six cohorts: 2003-04 (17%), 2004-05 (16%), 2005-06 (15%), 2006-07 (16%), 2007-08 (18%), and 2008-09 (18%). As illustrated in Figure 3.2, 10% of STEM students left their programs within the first six months. By the end of the second year, attrition rates increased to 23%. Attrition rates by individual student cohorts decreased by five to seven percentage points between the 2003-04 and 2008-09 cohorts. The decreases in attrition rates were gradual for the one-year and two-year time periods. However, most of the decrease in six-month attrition rates occurred between the 2005-06 and 2006-07 cohorts. Decreases in attrition rates for the cohorts 2003-04 to 2006-07 were highlight consistent with the increases in completion rates during the same time period. The fact that attrition increased between cohorts 2007-08 and 2008-09 are evidence to suggest that this trend in improvements may not have been sustained. Two-year attrtition rates varied by 15 percentage points among the five research partner institutions, from a low of 13% to a high of 28%.

Figure 3.2. Cumulative Attrition Rates by Student Cohort, STEM



Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database

Attrition Rates by Broad Field of Study

The data used in the analysis of attrition rates at the broad field of study level consisted of 14,246 students distributed across five broad fields of study as follows: biological and agricultural sciences (18%), engineering (53%), mathematics and computer sciences (12%), physical and earth sciences (five percent), social and behavioral sciences (12%). Of all STEM fields, students in the biological and agricultural sciences had the lowest attrition rates across all time periods (see Table 3.2). Students in engineering and mathematics and computer sciences had the highest attrition rates at the one-year and two-year time periods, with one-fifth of students in these fields of study dropping out within one year, and one-fourth of these students leaving their programs after two years. Increases in attrition rates were similar for all fields of study between each time period (four to six percentage point increases) with the exception of the one- to two-year transition for engineering and mathematics and computer science students where attrition rates increased by nearly 10 percentage points. The comparatively large increases in attrition among engineering and mathematics and computer science students between the six-month and two-year time period is pronounced when compared with other broad fields of study.

Attrition Rates by Gender

The data used in the analysis of attrition rates by gender consisted of 14,246 students. Women comprised just over one-third (34%) of the students. Overall, women had attrition rates similar to those of men at the six-month time period (nine percent and 10% respectively). The attrition rate gap widened by four percentage points at the one- and two-year time periods (see Table 3.2). Within one year of starting their programs, 15% of women and 19% of men had left the program without completing a degree. At the two-year time period, one in five women and about one in four men had left their programs. Two-year attrition rates among the five research partner institutions ranged 16 percentage points for both men and women, from 11% to 27% for women and 15% to 31% for men. The fact that women dropped out of STEM master's programs at lower rates than men is highly consistent with the fact that completion rates of women in STEM master's programs are higher than those of men.

Attrition Rates by Race/Ethnicity

The data used in the analysis of attrition rates by race/ethnicity consisted of 8,344 students distributed as follows: White (84%), Asian/Pacific Islander (6%), and Black/African American (5%), and Hispanic/Latino/Latina (5%). As with completion rates, students whose race/ethnicity was categorized as Native American/Alaska Native, two or more races, or unknown were excluded from this report because of small sample sizes.

Hispanic/Latino/Latina and Asian/Pacific Islander students had the lowest attrition rates at the six-month time period (eight percent and nine percent respectively), while White and Asian/Pacific Islander students had the lowest attrition rates at the one- and two-year time periods (see Table 3.2). Black/African American students had the highest attrition rates across all categories, and this was primarily driven by the high six-month attrition rate (15%) and the high increase in attrition rates between the six-month and one-year time periods (nine percentage points). Hispanic/Latino/Latina students had the second highest attrition rate at the two-year time period, which was primarily driven by the 11 percentage point increase in attrition rates between the six-month and one-year time periods. Although differences in two-year attrition rates among the five research partner institutions were calculated, the results were based upon such a small number of students in some categories that they were not reportable. The fact that attrition rates of Black/African American students were higher than those of all other race/ethnic groups is consistent with the comparatively low completion rates. This finding, along with the difference by gender, is among one of the most consistent findings generated by this particular dataset.

Attrition Rates by Citizenship

The data used in the analysis of attrition rates by citizenship consisted of 14,246 students, 62% of whom were U.S. citizens and permanent residents, and 38% of whom were temporary residents. Although attrition rates were similar for both groups at the one- and two-year time periods, temporary residents had lower attrition rates at the six-month time period than U.S. citizens and permanent residents (see Table 3.2). The six-month attrition rate was 8% for temporary residents and 11% for U.S. citizens and permanent residents. Within one year of starting their programs, between

17% and 18% of students in both groups had dropped out of the program without earning a degree, and by the two-year time period, 23% of students in both groups had left their programs. Despite the similarity in two-year attrition rates, the range among the five research partner institutions varied from 13% to 31% for U.S. citizens and permanent residents and 8% to 32% for temporary residents, a span of 18 and 24 percentage points respectively. Although one might expect temporary residents to have lower attrition rates than U.S. citizens and permanent residents, this was not true in all cases.

Attrition Rates by Age Group

The data used in the analysis of attrition rates by age groups consisted of 14,240 students distributed as follows: 20-24 years old (58%), 25-29 years old (26%), 30-34 years old (eight percent), and 35 years and older (seven percent). The youngest age group (20-24 years old) had the lowest attrition rates across all time periods, while the oldest cohort (35 years and older) had the highest attrition rates (see Table 3.2). The six-month attrition rate of 20-24 year olds was seven percent compared to 21% for students who were 35 years or older. Attrition rate increases were similar among all age groups between the six-month and one-year time periods (seven to eight percentage points). However, attrition rate increases between the one- and two-year time period were four to five percentage points for students under 30 years of age, and six to eight percentage points for students over 30 years old. By two years after beginning their course of study, 19% of students in the youngest age group (20-24 years old), and 36% of students in the oldest age group (35 years and older) had left their STEM programs without earning a master's degree. Although differences in two-year attrition rates among the five research partner institutions were calculated, the results were based upon such a small number of students in some categories that they were not reportable. This finding corroborates the earlier finding that younger students complete at higher rates than older students, and is among one of the strongest findings made possible by this dataset.

Table 3.2. Cumulative Attrition Rates for STEM Students

	within 6 months	within 1 year	within 2 years
Overall	10%	17%	23%
Field of Study			
Biological and Agricultural Sciences	6%	12%	18%
Engineering	10%	20%	25%
Mathematics and Computer Science	11%	20%	26%
Physical and Earth Sciences	10%	14%	19%
Social and Behavioral Sciences	10%	15%	19%
Gender			
Women	9%	15%	20%
Men	10%	19%	24%
Race / Ethnicity			
White	10%	17%	22%
Asian / Pacific Islander	9%	16%	20%
Black / African American	15%	24%	31%
Hispanic / Latino / Latina	8%	19%	26%
Citizenship			
U.S. Citizen / Permanent Resident	11%	17%	23%
Temporary Residents	8%	18%	23%
Age Group			
20-24 years old	7%	15%	19%
25-29 years old	11%	19%	24%
30-34 years old	16%	23%	29%
35 years and older	21%	28%	36%

Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database

Median Time-to-Degree and Time-to-Attrition in STEM Programs

Although the CGS project team calculated median time-to-degree for a range of student populations (by broad field of study, gender, citizenship, race/ethnicity, and age group), the result was largely consistent: students in STEM programs had a median time-to-degree of 23 months. Students in the social and behavioral sciences had the lowest median time-to-degree (21 months) and students in the physical and earth sciences had the longest time-to-degree (27 months). Median time-to-degree was the same regardless of gender and citizenship, but differed by one month in regards to race/ethnicity. Asian/Pacific Islander students in STEM programs had the lowest median time-to-degree of 23 months, while all other race/ethnicity categories had median time-to-degrees of 24 months. Additionally, the analysis of age groups revealed that median time-to-degree ranged from 23 months for the younger cohorts to 28 months for those students 35 years or older.

The same holds true for median time-to-attrition. Overall, students in STEM programs had a median time-to-attrition of eight months. Median time-to-attrition ranged from eight months in engineering and mathematics and computer science to 11 months in biological and agricultural sciences. Students in both the physical and earth sciences and social and behavioral sciences programs had a median time-to-attrition of nine months. Median time-to-attrition in STEM fields was the same regardless of gender and citizenship, but varied slightly when considering race/ethnicity. White and Asian/Pacific Islander students had the lowest median time-to-attrition of eight months, while Black/African American students had median time-to-attrition of nine months, and Hispanic/Latino/Latina students had the highest median time-to-attrition at 10 months. The analysis by age group revealed that all age groups had median time-to-attrition of eight months, with the exception of those students 35 years or older who had a median time-to-attrition of six months.

The lack of variance in median time-to-degree and median time-to-attrition among STEM master's students is the likely result of a relatively short program of study. Unlike a doctoral program, which requires more credit hours, a comprehensive examination, and the completion of an independent research study, master's programs typically require around 32 credit hours and are structured in ways that allow students to complete within two or three years.

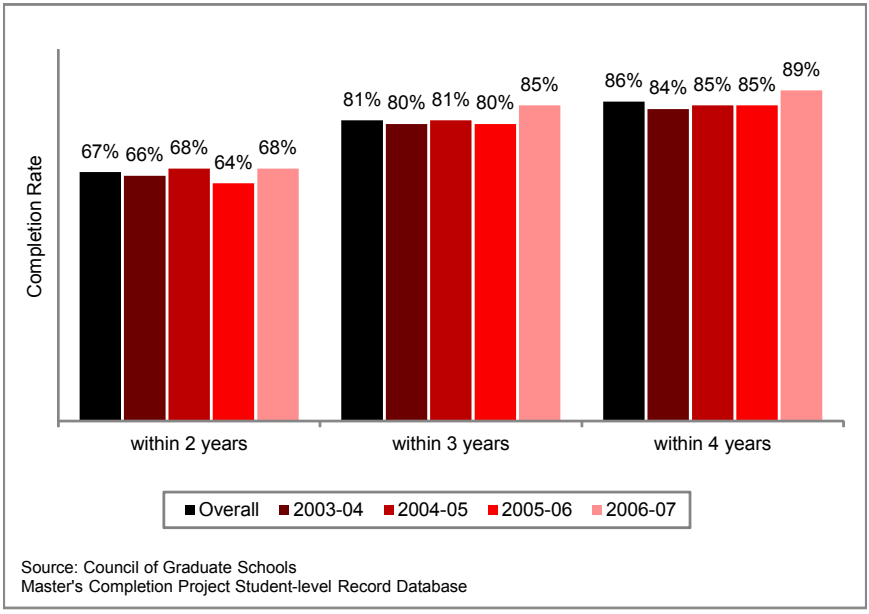
Comparison Between STEM and MBA Programs

One of the objectives of this pilot project was to compare completion rates, attrition rates, median time-to-degree, and median time-to-attrition between STEM programs and MBA programs. The intention of this exercise was to offer a point of reference from which STEM findings could be evaluated. The data used in this comparative analysis is comprised of the STEM data described in the previous sections of this chapter, as well as data made possible by MBA programs at the five research partner institutions. Completion rates and time-to-degree calculations were performed using 3,953 student-level records from MBA students enrolled in the four cohorts spanning 2003-04 to 2006-07. Attrition rates and time-to-attrition calculations were performed using 6,066 MBA students enrolled in the six cohort spanning 2003-04 to 2008-09.

Completion Rate Comparison

As illustrated in Figure 3.3, 67% of MBA students completed their program of study after two years, 81% completed after three years, and 86% completed after four years. These completion rates are substantially higher than the two-, three-, and four-year completion rates for STEM students seen in Figure 3.1 (41%, 60%, and 66% respectively). Whereas completion rates for STEM programs increased steadily between 2003-04 and 2008-09, completion rates for MBA programs students remained comparatively flat over the same time period. Of note, however, was the four to five percentage point increase between the 2005-06 and 2006-07 cohorts for MBA students. The difference between completion rates for STEM master's and MBA students is striking in its size and consistency. Although the rate at which MBA completion rates increase between three-year and four-year points is lower than the rate at which STEM completion rates increase, this may be the result of the fact that two-year MBA completion rates are so much higher. It is also interesting to note that cumulative four-year completion rates of MBA students ranged from a low of 70% to a high of 98% across the five research partner institutions. This 28 percentage point difference is substantially higher than the 20 percentage point difference in four-year completion rates seen in the STEM fields.

Figure 3.3. Cumulative Completion Rates by Student Cohort, MBA



Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database

By broad field of study, completion rates for STEM students lagged MBA students the most at the two-year time period by 22 to 34 percentage points, but this gap narrowed to close to 20 percentage points at the three- and four-year time periods (see Table 3.3). Furthermore, whereas completion rates for STEM students increased by 15 to 26 percentage points between the two- and three-year time periods, completion rates for MBA students only increased 14 percentage points. Part of this comparatively small increase in completion rates among MBA students may be explained by a ceiling effect, given the fact that MBA completion rates are already 67% after two years.

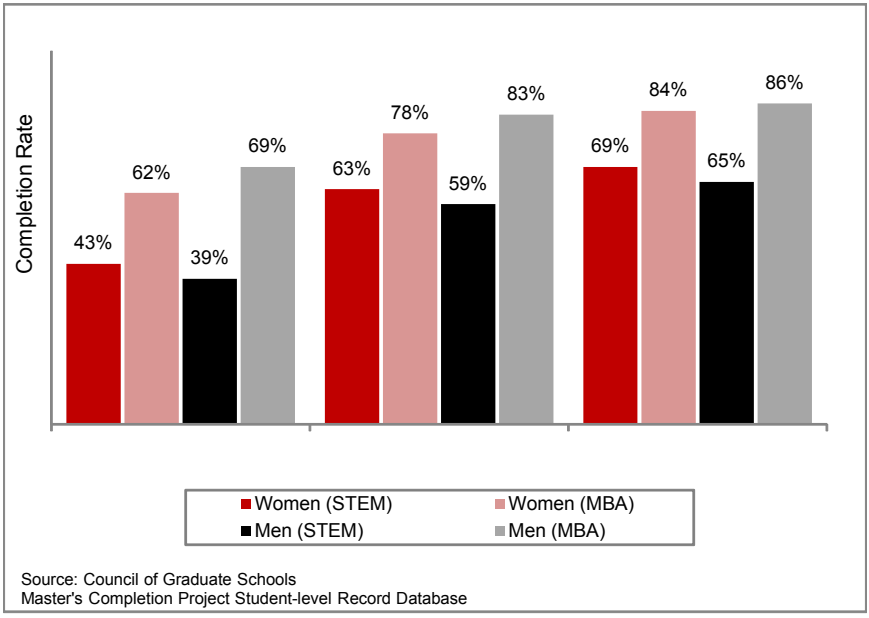
Table 3.3. Cumulative Completion Rates by Broad Field of Study

	within 2 years	within 3 years	within 4 years
Biological and Agricultural Sciences	40%	62%	69%
Engineering	40%	60%	65%
Mathematics and Computer Science	40%	59%	66%
Physical and Earth Sciences	33%	59%	67%
Social and Behavioral Sciences	45%	60%	65%
MBA	67%	81%	86%

Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database

Women in STEM programs completed their master's degrees at higher rates (four percentage points) than men across all time periods (see Figure 3.4). In MBA programs, men completed at higher rates than women, but the gap in completion rates narrowed from seven percentage points at the two-year time period to two percentage points at the four-year time period. Furthermore, in STEM programs, completion rates for men and women increased by 20 percentage points between the two- and three-year time periods, whereas in MBA programs the increase was lower: 16 percentage points for women and 14 percentage points for men. Moreover, the range of MBA completion rates for both men and women was wider across the five research partner institutions than the range of STEM completion rates. Specifically, the four-year completion rates for women in MBA programs ranged by 22 percentage points (from 76% to 98%) compared to 16 percentage point difference for women in STEM programs. Similarly, four-year completion rates for men in MBA programs ranged by 32 percentage points (from 66% to 98%) compared to 25 percentage point difference for men in STEM programs.

Figure 3.4. Cumulative Completion Rates by Gender, STEM vs. MBA



Completion rates for STEM students were approximately 20 percentage points lower than for MBA students across all time periods and most race/ethnicity categories, except for Hispanic/Latino/Latina students (see Table 3.4). Hispanic/Latino/Latina students in MBA programs had completion rates that were 28 to 34 percentage points higher than those in STEM programs. Completion rates for Hispanic/Latino/Latina students in MBA programs increased 24 percentage points between the two- and three-year time periods. This was substantially higher than the 18 percentage point change in completion rates for Hispanic/Latino/Latina in STEM programs.

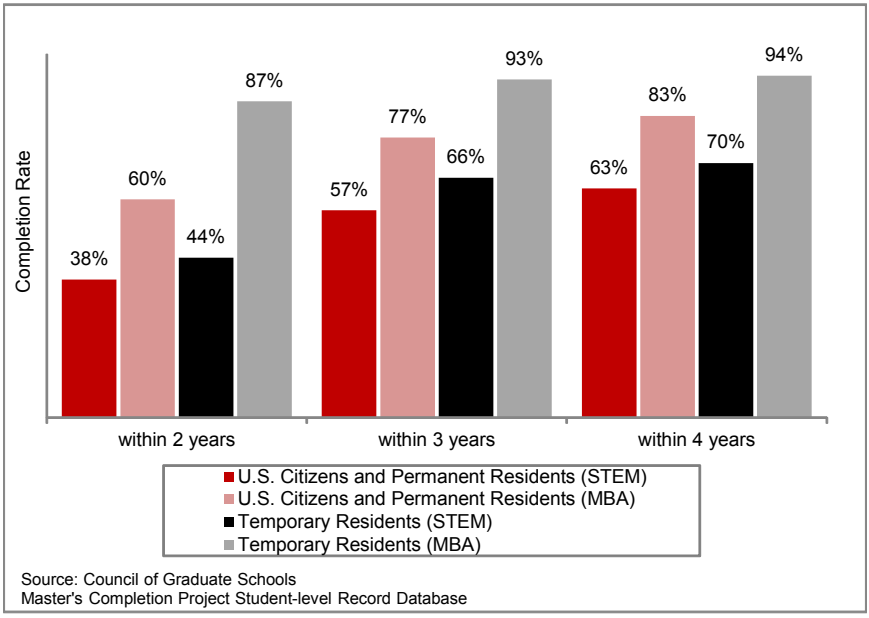
Table 3.4. Cumulative Completion Rates by Race/Ethnicity, STEM vs. MBA

	within 2 years		within 3 years		within 4 years	
	STEM	MBA	STEM	MBA	STEM	MBA
White	39%	60%	57%	76%	64%	82%
Asian / Pacific Islander	43%	64%	62%	84%	69%	89%
Black / African American	32%	52%	51%	69%	55%	76%
Hispanic / Latino / Latina	34%	62%	52%	86%	60%	89%

Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database

As Figure 3.5 illustrates, temporary residents had higher completion rates across all time periods than U.S. citizens and permanent residents in both STEM and MBA programs. Furthermore, increases in completion rates for temporary residents in MBA programs were much smaller across time periods (one to six percentage points) than for those in STEM programs (four to 22 percentage points). Completion rates for U.S. citizens and permanent residents in STEM programs were on average 20 percentage points lower than those in MBA programs across all time periods.

Figure 3.5. Cumulative Completion Rates by Citizenship, STEM vs. MBA



Students in the older age groups had lower overall completion rates in both STEM and MBA programs; however, the MBA cohorts had smaller completion rate gaps between the older and younger cohorts (three to seven percentage points) than did STEM cohorts (24 to 29 percentage points) (see Table 3.5). The increase in completion rates between time periods was similar for STEM and MBA cohorts at the three- to four-year transition, but at the two- to three-year transition, STEM cohorts had larger increases in completion rates than the MBA cohorts. For example, completion rates for 20-24 year old STEM students increased by 21 percentage points between the two- and three-year completion time periods, yet only increased by 12 percentage points for MBA students in the same age group.

Table 3.5. Cumulative Completion Rates by Age Group, STEM vs. MBA

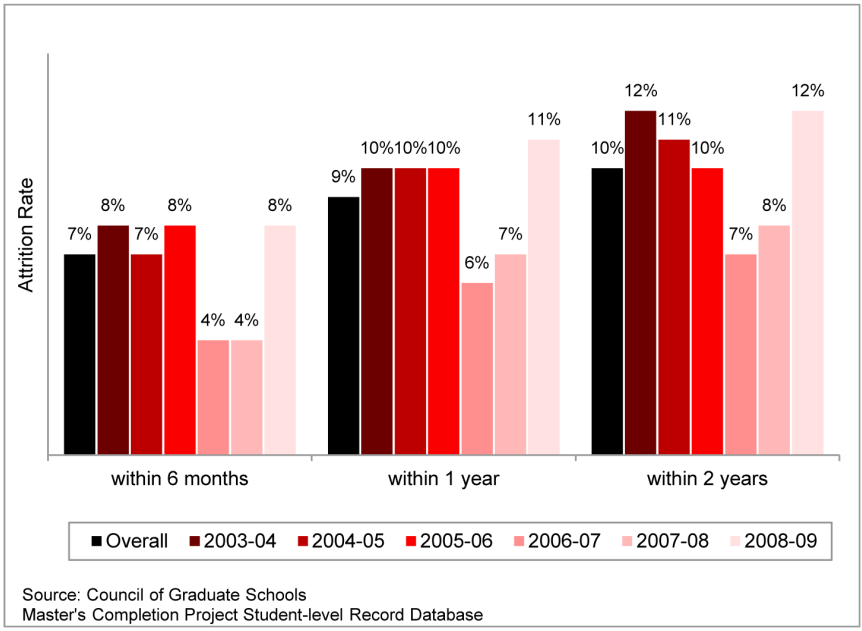
	within 2 years		within 3 years		within 4 years	
	STEM	MBA	STEM	MBA	STEM	MBA
20-24 years old	46%	72%	67%	84%	71%	87%
25-29 years old	37%	63%	56%	80%	63%	85%
30-34 years old	33%	70%	51%	83%	57%	87%
35 years and older	22%	65%	38%	79%	47%	84%

Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database

Attrition Rate Comparison

As Figure 3.6 illustrates, seven percent of MBA students left the program without earning a degree within six months, and 10% of MBA students left the program without completing the program within two years. Attrition rates in MBA programs fluctuated between 2003-04 and 2007-08. By comparison, as depicted earlier in Figure 3.2, attrition rates for students in STEM programs decreased by seven percentage points between the 2003-04 and 2008-09 cohorts at the six-month time period, and by five to six percentage points at the one- and two-year time periods. The cumulative two-year attrition rate ranged 18 percentage points (from a low of 3% to a high of 21%) across the five research partner institutions for MBA programs, slightly larger than the 15 percentage point range for STEM programs.

Figure 3.6. Cumulative Attrition Rates by Student Cohort, MBA



Across broad fields of study, attrition rates for STEM students were generally higher than attrition rates for MBA students, with the exception of biological and agricultural sciences in which the attrition rate was one percentage point lower than MBA students at six months (see Table 3.6). However, by two-years after starting their programs of study, the gap in attrition rates between STEM students and MBA students widened to eight to 16 percentage points. Furthermore, whereas attrition rates for STEM students increased by nine to 15 percentage points between the six-month and two-year time periods, attrition rates for MBA students only increased by three percentage points.

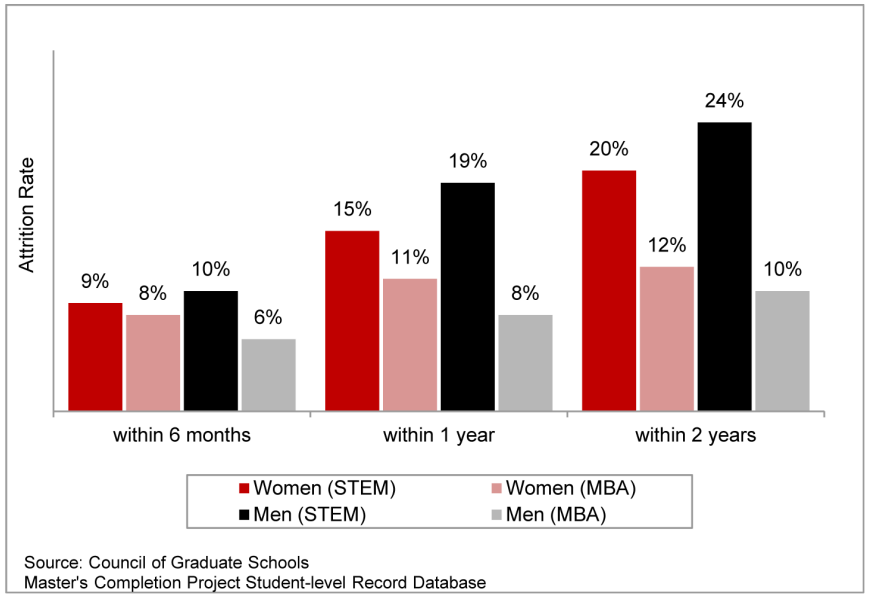
Table 3.6. Cumulative Attrition Rates by Broad Field of Study

	within 6 months	within 1 year	within 2 years
Biological and Agricultural Sciences	6%	12%	18%
Engineering	10%	20%	25%
Mathematics and Computer Science	11%	20%	26%
Physical and Earth Sciences	10%	14%	19%
Social and Behavioral Sciences	10%	15%	19%
MBA	7%	9%	10%

Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database

Women in STEM programs dropped out of their programs at lower rates (by one to four percentage points) than men across all time periods (see Figure 3.7). Women in MBA programs, however, dropped out at slightly higher rates (by two to three percentage points) than men. Additionally, in STEM programs, attrition rates for women increased less (between zero and three percentage points) between time periods than for men. In MBA programs, increases in attrition rates were similar for both men and women (at about two percentage points between each time period). The range of two-year attrition rates among MBA programs at the five research partner institutions was slightly larger than for STEM for both men and women. For women, the two-year attrition rates for MBA programs ranged by 18 percentage points (from 3% to 21%), compared to 16 percentage points for STEM programs. For men, the two-year attrition rates for MBA programs ranged by 20 percentage points (from 3% to 23%), compared to 16 percentage points for STEM programs.

Figure 3.7. Cumulative Attrition Rates by Gender, STEM vs. MBA



Two years after entering master's degree programs, attrition rates for STEM students were 10 to 19 percentage points higher than for MBA students across the race/ethnicity categories (see Table 3.7). At the two-year time period, attrition rates for MBA students ranged from seven percent for Hispanic/Latino/Latina students to 16% for Black/African American students, while attrition rates for STEM students ranged from 20% for Asian/Pacific Islander students to 31% for Black/African American students. Within MBA programs, the majority of attrition occurred within the first six months, and this was followed by slight increases (one to five percentage points) in attrition rates over the subsequent time periods. In STEM programs, increases in attrition were much higher, ranging from seven to 11 percentage points between the six-month and one-year time periods and from five to seven percentage points between the one- and two-year time periods. The fact that attrition rates of Black/African American students are higher than other race/ethnic groups in STEM master's programs and MBA programs corroborates the finding earlier in this report that completion rates for Black/African American students were lower in STEM master's and MBA programs.

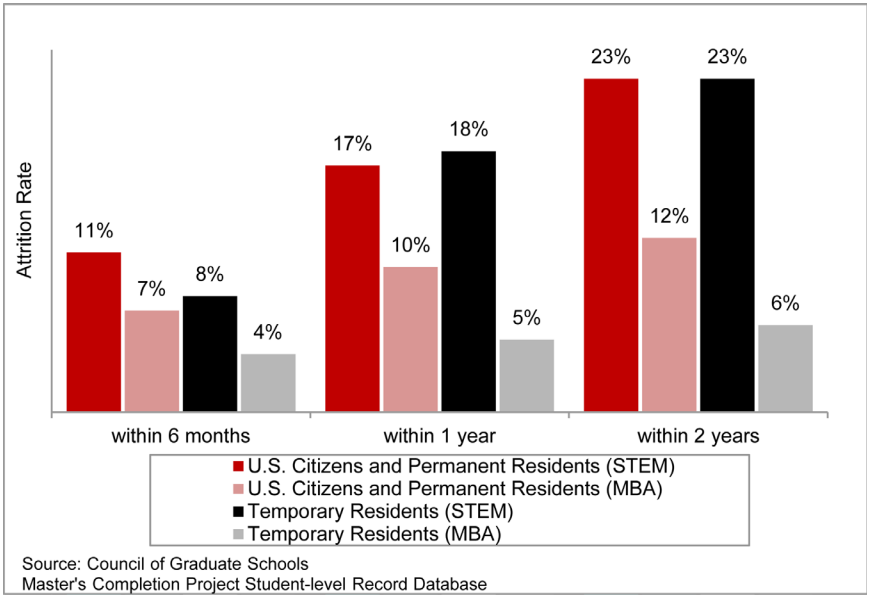
Table 3.7. Cumulative Attrition Rates by Race/Ethnicity, STEM vs. MBA

	within 6 months		within 1 year		within 2 years	
	STEM	MBA	STEM	MBA	STEM	MBA
White	10%	8%	17%	11%	22%	12%
Asian/Pacific Islander	9%	6%	16%	9%	20%	10%
Black/African American	15%	8%	24%	13%	31%	16%
Hispanic/Latino/Latina	8%	4%	19%	6%	26%	7%

Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database

As Figure 3.8 illustrates, attrition rates were similar for U.S. citizens and permanent residents and temporary residents in STEM programs. In MBA programs, however, attrition rates were higher for U.S. citizens and permanent residents than for temporary residents by three to six percentage points. After two years of study, attrition rates for U.S. citizens and permanent residents in STEM programs was nearly double that of those in MBA programs (23% vs. 12%), whereas attrition rates for temporary residents in STEM programs was nearly quadruple that of those in MBA programs (23% vs. six percent).

Figure 3.8. Cumulative Attrition Rates by Citizenship, STEM vs. MBA



Students in the older age groups had higher overall attrition rates in STEM programs, but fairly consistent attrition rates in MBA programs (see Table 3.8). Attrition rates in STEM programs increased by seven to eight percentage points between six months and one year, and by another four to eight percentage points between years one and two. For MBA programs, attrition rates increased only one to three percentage points per time period.

Table 3.8. Cumulative Attrition Rates by Age Group, STEM vs. MBA

	within 6 months		within 1 year		within 2 years	
	STEM	MBA	STEM	MBA	STEM	MBA
20-24 years old	7%	6%	15%	8%	19%	9%
25-29 years old	11%	7%	19%	10%	24%	11%
30-34 years old	16%	6%	23%	7%	29%	9%
35 years and older	21%	8%	28%	10%	36%	12%

Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database

Median Time-to-Degree and Time-to-Attrition Comparison

Overall students in STEM programs had a median time-to-degree of 23 months whereas students in MBA programs completed slightly faster at 21 months (see Table 3.9). The median time-to-degree was similar for STEM programs regardless of gender, citizenship, and race/ethnicity, but varied by five months within the age group categories. Within MBA programs, the median time-to-degree was similar regardless of gender, race/ethnicity, and age group, but varied by seven months within the citizenship categories. For example, median time-to-degree of U.S. citizens and permanent residents was 21 months compared with 14 months for temporary residents.

Table 3.9. Median Time-to-Degree, STEM vs. MBA

	Median Time-to-degree (months)	
	STEM	MBA
By Field of Study	23	21
Women	23	20
Men	23	21
U.S. Citizen or Permanent Resident	23	21
Temporary Resident	23	14
20-24 years old	23	19
25-29 years old	24	21
30-34 years old	24	21
35 years and older	28	20
White	24	21
Asian / Pacific Islander	23	21
Black / African American	24	21
Hispanic / Latino / Latina	24	21

Source: Council of Graduate Schools
Master's Completion Project Student-level Record Database

Overall, students in STEM programs had a median time-to-attrition of eight months whereas students in MBA programs dropped out earlier, with a median time-to-attrition of four months (see Table 3.10). The median time-to-attrition was similar within STEM programs regardless of gender or citizenship, but varied by two months within the age group categories and within race/ethnicity categories. Within MBA programs, the median time-to-degree was similar regardless of gender, citizenship, or age group, but varied by three months within the race/ethnicity categories.